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A Lincoln Electric Company

! IMPORTANT !
- For Your Safety -
Read this manual before
installing or using this equipment

ARC PRODUCTS, INC

MA-20 MAGNETIC ARC CONTROL

OPERATIONS AND SERVICE MANUAL

1245 30th Street
San Diego, CA 92154-3477
619-628-1022
619-628-1028 FAX
sales@arc-products.com
service@arc-products.com
www.ap-automation.com
www.arc-products.com

THANK YOU!!!

. . . for purchasing **Arc Products** Equipment. Our commitment to you is to provide an ever expanding family of quality arc positioning equipment, controller and accessories. Please take the time to read the following pages as they contain important information regarding proper use of this product and of welding/cutting safety and procedures.

WHO DO I CONTACT		
For help: • Contact your distributor For additional information, such as, Technical Manuals, Service and Parts, Circuit and Wire Diagrams, User's Guides, Distributor Directories • Contact your distributor	To file a claim for loss or damage during shipment • Contact your delivering carrier For assistance in filing or settling claims, • contact your distributor and/or equipment manufacturer's Transportation Department	How to contact Arc Products: Call: 619-628-1022 Fax: 619-628-1028 E-mail: sales@arc-products.com service@arc-products.com Write: Arc Products Attn: Customer Service 1245 30th Street San Diego, CA 92154
ALWAYS PROVIDE MODEL NAME AND PART NUMBER		

Overview

OVERVIEW *IV*
TABLE OF CONTENTS *V*
TABLE OF TABLES *VII*
TABLE OF FIGURES *VIII*

SAFETY

SAFETY PRECAUTIONS *X*
ADDITIONAL SAFETY HAZARDS *XII*

MA-20 MAGNETIC ARC CONTROL SYSTEM

DESCRIPTION OF EQUIPMENT *3*
INSTALLATION *6*
OPERATION *17*
MAINTENANCE *25*
DRAWING AND PARTS LIST *27*
TROUBLESHOOTING *43*
CIRCUIT DESCRIPTIONS *45*
SCHEMATICS AND BLOCK DIAGRAMS *47*

INDEX

INDEX *53*

Table of Contents

OVERVIEW IV
TABLE OF CONTENTS V
TABLE OF TABLES VII
TABLE OF FIGURES VIII

SAFETY

SAFETY PRECAUTIONS

DEFINITIONS X
NOTE X
CAUTION X
WARNING X
DANGER. X
SAFETY INFORMATION X
ELECTRIC SHOCK X
FIRE SAFETY XI

ADDITIONAL SAFETY HAZARDS

FIRE AND EXPLOSION XII
FALLING EQUIPMENT XII
HOT PARTS XII
MOVING PARTS XII
MAGNETIC FIELDS CAN AFFECT PACEMAKERS XII
WELDING WIRE XII
FLYING PIECES OF METAL OR DIRT XII
OVERHEATED EQUIPMENT XII
HIGH FREQUENCY XII
SAFETY REFERENCES XII

MA-20 MAGNETIC ARC CONTROL SYSTEM

DESCRIPTION OF EQUIPMENT

DESCRIPTION OF EQUIPMENT 3
MA-20 CONTROL UNIT 3
MAGNETIC ARC CONTROL PROBES 3
MP-1 PROBE 3
MP-100 PROBE 3
MP-2 PROBE 4
MP-22 PROBE 4

INSTALLATION

INSTALLATION 6
GENERAL SETUP 6
OPTIONS AND SPECIALS 6
CONTROL UNIT LOCATION 6
MAGNETIC ARC PROBE MOUNTING 6
MP-1 & MP-100 6
MP-2 6
MP-22 7

OPERATION

OPERATION 17
GENERAL OPERATIONAL DESCRIPTION 17
CONTROL FEATURES & FUNCTIONS 17
REMOTE / PANEL POSITION CONTROL 17
STABILIZE / OSCILLATE 17
SWEEP 17

LEFT & RIGHT DWELL . . . 17
AMPLITUDE . . . 17
POSITION . . . 17
FINAL TAPER . . . 17
REMOTE START . . . 18
NORMALLY OPEN START . . . 18
NORMALLY CLOSED START . . . 19
NORMALLY OPEN START USING TAPER . . . 19
NORMALLY CLOSED START USING TAPER . . . 20
INSTALLATION . . . 21

MAINTENANCE

MAINTENANCE . . . 25
MAINTENANCE REQUIREMENTS . . . 25
CONTROL UNIT . . . 25
PROBES ASSEMBLIES. . . . 25
CABLE ASSEMBLY . . . 25
PREVENTIVE MAINTENANCE SCHEDULE . . . 25
MONTHLY MAINTENANCE . . . 25
PROBE ASSEMBLIES . . . 25
PROPER FUNCTION . . . 25
TEST . . . 25
QUARTERLY MAINTENANCE . . . 25
SEMI ANNUAL MAINTENANCE . . . 25
CONTROL UNIT ASSEMBLY . . . 25

DRAWING AND PARTS LIST

DRAWING AND PARTS LIST . . . 27

TROUBLESHOOTING

TROUBLESHOOTING . . . 43
RECOMMENDED SPARES FOR TROUBLESHOOTING . . . 43
PROBLEM 1. . . . 43
PROBLEM 2. . . . 43
PROBLEM 3. . . . 43

CIRCUIT DESCRIPTIONS

CIRCUIT DESCRIPTIONS . . . 45
SYSTEM WIRING DIAGRAM . . . 45
MAIN BOARD ASSEMBLY . . . 45

SCHEMATICS AND BLOCK DIAGRAMS

SCHEMATICS AND BLOCK DIAGRAMS . . . 47

INDEX

INDEX . . . 53

Table of Tables

MA-20 MAGNETIC ARC CONTROL SYSTEM

DESCRIPTION OF EQUIPMENT 3

INSTALLATION 6

TABLE 1 - MA-20 MAGNETIC ARC CONTROL SPECIFICATIONS 8
TABLE 2 - MA-20 MAGNETIC ARC CONTROL SYSTEM COMPONENTS SPECIFICATIONS . 9
TABLE 3 - MP-1 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS. 10
TABLE 4 - MP-100 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS 11
TABLE 5 - MP-2 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS. 12
TABLE 6 - MP-22 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS 13

OPERATION 17

TABLE 7 - REMOTE START N.O. INHIBIT SETTINGS 18
TABLE 8 - REMOTE START N.C. INHIBIT SETTINGS 19
TABLE 9 - REMOTE TAPER N.C. SETTINGS 20
TABLE 10 - REMOTE TAPER N.O. SETTINGS 20

MAINTENANCE 25

DRAWING AND PARTS LIST 27

TABLE 11 - MA-20 MAGNETIC ARC CONTROL PARTS LIST 29
TABLE 12 - POWER SWITCH ASSEMBLY PARTS LIST 30
TABLE 13 - TRANSFORMER ASSEMBLY PARTS LIST. 31
TABLE 14 - PROBE CABLE HARNESS PARTS LIST 32
TABLE 15 - REMOTE INTERFACE CABLE HARNESS PARTS LIST. 33
TABLE 16 - MP-1 MAGNETIC ARC PROBE PARTS LIST 35
TABLE 17 - MP-2 MAGNETIC ARC PROBE PART LIST 37
TABLE 18 - MP-22 MAGNETIC ARC PROBE PARTS LIST. 39
TABLE 19 - MP-100 MAGNETIC ARC PROBE PARTS LIST 41
TABLE 20 - VOLTAGE SELECTOR SWITCH ASSEMBLY PARTS LIST 42

TROUBLESHOOTING 43

TABLE 21 - TROUBLESHOOTING 43
TABLE 22 - RECOMMENDED SPARE PARTS 43
TABLE 23 - VOLTAGE POINTS MAIN BOARD 43

CIRCUIT DESCRIPTIONS 45

SCHEMATICS AND BLOCK DIAGRAMS 47

Table of Figures

MA-20 MAGNETIC ARC CONTROL SYSTEM

DESCRIPTION OF EQUIPMENT 3

FIGURE 1 - MP-1 AND MP-100 MOUNTING METHOD, CROSS SEAM . . . 4
FIGURE 2 - MP-1 AND MP-100 MOUNTING METHOD, ALONG SEAM . . . 4
FIGURE 3 - MP-2 MOUNTING METHOD, ALONG SEAM . . . 5
FIGURE 4 - MP-2 MOUNTING METHOD, CROSS SEAM . . . 5
FIGURE 5 - MP-22 MOUNTING METHOD, ALONG SEAM . . . 5
FIGURE 6 - MP-22 MOUNTING METHOD, CROSS SEAM . . . 5

INSTALLATION 6

FIGURE 7 - MA-20 MAGNETIC ARC CONTROL UNIT . . . 8
FIGURE 8 - MA-20 MAGNETIC ARC CONTROL SYSTEM COMPONENTS . . . 9
FIGURE 9 - MP-1 MAGNETIC ARC PROBE ASSEMBLY . . . 10
FIGURE 10 - MP-100 MAGNETIC ARC PORBE ASSEMBLY . . . 11
FIGURE 11 - MP-2 MAGNETIC ARC PROBE ASSEMBLY . . . 12
FIGURE 12 - MP-22 MAGNETIC ARC PROBE ASSEMBLY . . . 13
FIGURE 13 - INTERCONNECTION DIAGRAM . . . 14
FIGURE 14 - MA-20 MAGNETIC ARC CONTROL MOUNTING DIMENSIONS . . . 15
FIGURE 15 - AMPLITUDE SETTINGS . . . 16
FIGURE 16 - POSITION SETTINGS . . . 16
FIGURE 17 - SWEEP SETTINGS. . . . 16
FIGURE 18 - DWELL SETTINGS . . . 16

OPERATION 17

FIGURE 19 - TAPER FUNCTION . . . 18
FIGURE 20 - DEFAULT INHIBIT DIP SWITCH SETTINGS . . . 19
FIGURE 21 - INHIBIT NC DIP SWITCH SETTINGS . . . 19
FIGURE 22 - DEFAULT TAPER DIP SWITCH SETTINGS . . . 20
FIGURE 23 - DEFAULT OSC / STAB DIP SWITCH SETTINGS . . . 20
FIGURE 24 - TAPER NC DIP SWITCH SETTINGS . . . 20
FIGURE 25 - REMOTE N.O. TAPER INTERFACE . . . 21
FIGURE 26 - REMOTE N.C. TAPER INTERFACE . . . 22
FIGURE 27 - REMOTE N.C. INHIBIT INTERFACE . . . 22
FIGURE 28 - REMOTE N.O. INHIBIT INTERFACE . . . 23
FIGURE 29 - DEFAULT POSITION DIP SWITCH SETTINGS . . . 23

MAINTENANCE 25

DRAWING AND PARTS LIST 27

FIGURE 30 - MA-20 MAIN BOARD LAYOUT . . . 27
FIGURE 31 - MA-20 MAGNETIC ARC CONTROL EXPLODED VIEW . . . 28
FIGURE 32 - POWER SWITCH ASSEMBLY EXPLODED VIEW . . . 30
FIGURE 33 - TRANSFORMER ASSEMBLY EXPLODED VIEW . . . 31
FIGURE 34 - PROBE CABLE HARNESS EXPLODED VIEW . . . 32
FIGURE 35 - REMOTE INTERFACE CABLE HARNESS EXPLODED VIEW . . . 33
FIGURE 36 - MP-1 MAGNETIC ARC PROBE EXPLODED VIEW . . . 34
FIGURE 37 - MP-2 MAGNETIC ARC PROBE EXPLODED VIEW. . . . 36
FIGURE 38 - MP-22 MAGNETIC ARC PROBE EXPLODED VIEW . . . 38
FIGURE 39 - MP-100 MAGNETIC ARC PROBE EXPLODED VIEW . . . 40
FIGURE 40 - VOLTAGE SELECTOR SWITCH ASSEMBLY EXPLODED VIEW . . . 42

TROUBLESHOOTING 43

CIRCUIT DESCRIPTIONS 45

FIGURE 41 - MA-20 MAGNETIC ARC CONTROL SIGNAL FLOW . . . 46

SCHEMATICS AND BLOCK DIAGRAMS 47

FIGURE 42 - MP-1 MAGNETIC ARC PROBE BLOCK DIAGRAM. . . . 47

FIGURE 43 - MP-2 MAGNEITC ARC PROBE BLOCK DIAGRAM. 47
FIGURE 44 - MA-20 MAGNETIC ARC CONTROL BLOCK DIAGRAM 48
FIGURE 45 - MA-20 MAGNETIC ARC CONTROL BLOCK DIAGRAM (CONT.) 49
FIGURE 46 - MP-22 MAGNETIC ARC PROBE BLOCK DIAGRAM 50
FIGURE 47 - MP-100 MAGNETIC ARC PROBE BLOCK DIAGRAM 50
FIGURE 48 - MA-20 MAGNETIC ARC CONTROL INTERFACE CABLE SCHEMATIC . . . 51

SAFETY

SAFETY PRECAUTIONS

THIS MANUAL HAS BEEN DESIGNED FOR EXPERIENCED WELDING AND CUTTING EQUIPMENT OPERATORS AND MUST BE READ COMPLETELY BEFORE USING THIS EQUIPMENT. IF YOU LACK EXPERIENCE OR ARE UNFAMILIAR WITH THE PRACTICES AND SAFE OPERATION OF WELDING AND CUTTING EQUIPMENT, PLEASE CONSULT YOUR FOREMAN. DO NOT ATTEMPT TO INSTALL, OPERATE, OR PERFORM MAINTENANCE ON THIS EQUIPMENT UNLESS YOU ARE QUALIFIED AND HAVE READ AND UNDERSTOOD THIS MANUAL. IF IN DOUBT ABOUT INSTALLING OR OPERATING THIS EQUIPMENT, CONTACT YOUR DISTRIBUTOR OR THE CUSTOMER SERVICE DEPARTMENT OF ARC PRODUCTS.

DEFINITIONS

Throughout this manual, NOTE, CAUTION, WARNING and DANGER are inserted to call attention to particular information. The methods used to identify these highlights and the purpose for which each is used, are as follows:

NOTE

Operational, procedural, and background information which aids the operator in the use of the machine, helps the service personnel in the performance of maintenance, and prevents damage to the equipment.

CAUTION

An operational procedure which, if not followed, may cause minor injury to the operator, service personnel and/or bystanders.

WARNING

An operational procedure which, if not followed, may cause severe injury to the operator, service personnel and/or bystanders.

DANGER

An operational procedure which, if not followed, will cause severe injury or even death to the operator, service personnel or bystanders.

SAFETY INFORMATION

Safety is a combination of good judgment and proper training. Operation and maintenance of any arc welding and cutting equipment involves potential hazards. Individuals who are unfamiliar with cutting and welding equipment, use faulty judgment or lack proper training, may cause injury to themselves and others. Personnel should be alerted to the following potential hazards and the safeguards necessary to avoid possible injury. In addition, before operating this equipment, you should be aware of your employer's safety regulations.

BE SURE TO READ THIS MANUAL BEFORE INSTALLING OR USING THIS EQUIPMENT.

BE SURE TO READ AND FOLLOW ALL AVAILABLE SAFETY REGULATIONS BEFORE USING THIS EQUIPMENT.

ELECTRIC SHOCK

THE VOLTAGES PRESENT IN THE WELDING AND CUTTING ENVIRONMENT CAN CAUSE SEVERE BURNS TO THE BODY OR FATAL SHOCK. THE SEVERITY OF ELECTRICAL SHOCK IS DETERMINED BY THE PATH AND THE AMOUNT OF CURRENT THROUGH THE BODY.

A Install and continue to maintain equipment according to USA Standard C1, National Electric Code.

B Never allow live metal parts to touch bare skin or any wet clothing. Use only dry gloves.

C When welding or cutting in a damp area, or when standing on metal, make sure you are well insulated by wearing dry gloves, rubber soled shoes, and by standing on a dry board or platform.

D Do not use worn or damaged welding or torch cables. Do not overload the cables. Use well maintained equipment.

E When not welding/cutting, turn equipment OFF. Accidental grounding can cause overheating and create a fire hazard. Do not coil or loop the cable around parts of the body.

F The ground cable should be connected to the work piece as close to the work area as possible. Grounds connected to building framework or other locations remote to the

work area reduce efficiency and increase the potential hazard of electric shock. Avoid the possibility of the welding or cutting current passing through lifting chains, crane cables or other electrical paths.

G Keep everything dry you might touch, including clothing, the work area, welding gun, torch and welding or cutting machines. Fix water leaks immediately. Do not operate equipment standing in water.

H Never use a cutting torch or welding gun which is damaged or contains cracked housing.

I Refer to AWS-Z49.1 for grounding recommendations.

SKIN AND EYE BURNS RESULTING FROM BODY EXPOSURE TO ELECTRIC-ARC WELDING AND CUTTING RAYS OR HOT METAL CAN BE MORE SEVERE THAN SUNBURN.

A Use a proper face shield fitted with the correct filter (#10 or greater) and cover plates to protect your eyes, face, neck and ears from the sparks and rays of the cutting/welding arc when cutting/welding or observing cutting/welding. Warn bystanders not to watch the arc and not to expose themselves to the cutting/welding arc rays or to hot metal.

B Wear flameproof gauntlet-type gloves, a heavy long-sleeve shirt, cuff-less trousers, high-topped shoes, and a welding helmet or cap (for hair protection) to protect the skin from arc rays and hot sparks or hot metal.

C Protect other nearby personnel from arc rays and hot sparks with a suitable non-flammable partition.

D Always wear safety glasses or goggles when in a cutting or welding area. Use safety glasses with side shields or goggles when chipping slag or grinding. Chipped slag is hot and may travel a considerable distance. Bystanders should also wear safety glasses or goggles.

E Compressed gas cylinders are potentially dangerous, refer to the suppliers for proper handling procedures.

F Wear ear plugs or other ear protection devices when operating cutting or welding equipment.

FIRE SAFETY

HOT SLAG OR SPARKS CAN CAUSE A SERIOUS FIRE WHEN IN CONTACT WITH COMBUSTIBLE SOLIDS, LIQUIDS OR GASES.

A Move all combustible materials well away from the cutting area or completely cover materials with a non-flammable covering. Combustible materials include but are not limited to wood, clothing, sawdust, gasoline, kerosene, paints, solvents, natural gases, acetylene, propane, and similar articles.

B Do not weld, cut or perform other hot work on used barrels, drums, tanks or other containers until they have been completely cleaned. There must be no substances in the container which might produce flammable or toxic vapors.

C For fire protection, have suitable extinguishing equipment handy for instant use.

WELDING AND CUTTING FUMES AND GASES, PARTICULARLY IN CONFINED SPACES, CAN CAUSE DISCOMFORT AND PHYSICAL HARM IF INHALED OVER AN EXTENDED PERIOD OF TIME.

A At all times, provide adequate ventilation in the welding and cutting area by either natural or mechanical means. Do not weld or cut on galvanized, zinc, lead, beryllium or cadmium materials unless positive mechanical ventilation is provided to prevent inhaling fumes and gases from these materials.

B Do not weld or cut in locations close to chlorinated hydrocarbon vapors coming from degreasing or spraying operations. The heat of arc rays can react with solvent vapors to form phosgene, a highly toxic gas, and other irritant gases.

C If you develop momentary eye, nose or throat irritation during welding or cutting, it is an indication that the ventilation is not adequate. Stop work and take the necessary steps to improve ventilation in the welding or cutting area. Do not continue to weld or cut if physical discomfort persists.

D Use an air supplied respirator if ventilation is not adequate to remove all fumes and gases.

E Beware of gas leaks. Welding or cutting gases containing argon are denser than air and will replace air when used in confined spaces. Do not locate gas cylinders in confined spaces. When not in use, shut OFF the gas supply at its source.

Refer to AWS Standard Z49.1 for specific ventilation recommendations.

ADDITIONAL SAFETY HAZARDS

FIRE AND EXPLOSION

Fire and Explosion can result from placing units on, over, or near combustible surfaces.

- Do not install units on, over, or near combustible surfaces.
- Do not install unit near flammables.

FALLING EQUIPMENT

Falling Equipment can cause serious personal injury and equipment damage.

- Use lifting eyes to lift unit only, not running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift units.

- If using fork lifts to move units, be sure forks are long enough to extend beyond opposite side of the unit.

HOT PARTS

Hot parts can cause severe burns.

- Do not touch hot parts bare handed.
- Allow cooling period before working on gun or torch.

MOVING PARTS

Moving Parts can cause injury.

- Keep away from moving parts, such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.

- Keep away from pinch points, such as mechanical slides, drive rolls, carriage assemblies, etc.

MAGNETIC FIELDS CAN AFFECT PACEMAKERS

Magnetic Fields from High Currents can affect pacemaker operation.

- Pacemaker wearers should keep away.
- Wearers of pacemakers should consult their doctors before going near arc welding, gouging, plasma cutting, or spot welding operations.

WELDING WIRE

Welding wire can cause puncture wounds.

- Do not press gun trigger until instructed to do so.
- Do not point the gun toward any part of the body, other people, or any metal when threading welding wire through the gun.

FLYING PIECES OF METAL OR DIRT

Flying pieces of metal or dirt can injure eyes.

- Wear safety glasses with side shields or face shields.

OVERHEATED EQUIPMENT

High output power for long durations can cause equipment to overheat.

- Allow cooling periods.
- Reduce current or reduce duty cycle before starting to weld again.
- Follow rated duty cycle.

HIGH FREQUENCY

High Frequency can cause electrical interference.

- Take appropriate precautions to shield sensitive electronic equipment, such as computers, Programmable Logic Controllers, etc.
- Be sure to ground each component of the system to one ground point, i.e., Earth Ground (Earth) or Protective Earth (PE).

SAFETY REFERENCES

The following publications provide additional information on important welding safeguards.

A ANSI/ASC 249.1-1988, American National Standard "Safety in Welding and Cutting".

B Bulletin No. F4-1, "Recommended Safe Practices for the Preparation for Welding and Cutting Containers and Piping that have held Hazardous Substances".

C OSHA Safety and Health Standards, 29CFR 1910, available from the United States Department of Labor, Washington, DC 20210.

D NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 00210.

E NEMA Standards Publication/No. EW1-1989, Electric Arc-Welding Apparatus, approved as ANSI C87.1-1989. Available from National Electrical Manufacturers Association, 155 E. 44th Street, New York, NY 10017.

MA-20 Magnetic Arc Control System

DESCRIPTION OF EQUIPMENT

The AP AUTOMATION MA-20 Magnetic Arc Control System is a precise, controllable means for oscillating, stabilizing, or positioning a welding arc. This allows the operator to control heat distribution, minimize undercutting, reduce porosity, improve penetration, provide uniform sidewall fusion and improve the overall integrity of the weld. Used with the Model MP-1, MP-100, MP-2, and MP-22 Probes or the Cyclomatic™ 4604, 4608C, and 4615 Probes.

MA-20 CONTROL UNIT

The control unit is a heavy gauge steel enclosure containing the electronic circuitry used in the system. A microprocessor and other solid state circuits are used to provide long, trouble-free operation. The control unit operates on 115/230VAC, 50/60 Hz commercial power, capable of supplying approximately 2 amps peak current. The unit has a lighted power switch and fuse holder mounted on the exterior of the unit. See Table 1 - MA-20 Magnetic Arc Control Specifications, Table 2 - MA-20 Magnetic Arc Control System Components Specifications, Figure 7 - MA-20 Magnetic Arc Control Unit, and Figure 8 - MA-20 Magnetic Arc Control System components for additional specifications.

The system is operated using the controls, potentiometers, pushbuttons located on the front panel. Additional switches are located on the inside of the control unit on the main board via DIP switches. A heatsink mounted on the inside of the control unit allows adequate cooling for the heat dissipating devices.

Two connectors located on the bottom of the unit provide for connection of the probe cable and a remote interface cable.

The MA-20 system is primarily intended for use with the TIG (GTAW) process, but can also be used with the PLASMA (PAW) welding process. Additionally, the MA-20 System can be used with spray MIG and Sub Arc processes. With this system, the operator can widen or narrow the weld bead as required to provide control of the heat affected zone, undercutting, and irregular joint edges. The controlled magnetic field also reduces arc blow and arc wander, while the motion of the arc stirs the molten weld puddle, reducing porosity and providing a more uniform bead surface pattern.

The MA-20 is a simple, reliable control with an oscillating frequency range up to 50 Hz. The Pulse Width Modulation (PWM) design provides a constant magnetic field for a given amplitude setting over the entire frequency range. Control functions allow independent control of each of the key waveform parameters, and left and right dwell intervals are also independently adjustable. The control unit is convection cooled, allowing for less power dissipation and lower operating temperatures.

The top panel or door of the control unit contains all the controls needed for operation. There are three Light Emitting Diode (LED) indicators in a pattern to the left of the control knobs. Each lamp will illuminate alternately during arc oscillation. When power is applied to the Control Unit, the Power On LED will also illuminate.

The MA-20 Control unit has additional features selected from inside the control enclosure. These features, Stabilize/Oscillate mode (STAB/OSC) and Remote / Panel Position Control, are selected via DIP Switches on the main board.

Stabilize / Oscillate mode allows the operator the ability to oscillate the arc either across the seam or along the seam depending on how the probe is mounted on the torch (Oscillate Mode), or to stabilize the arc, positioning the arc in the desired location (Stabilize Mode).

Remote / Panel Position Control allow the operator to control the arc position of the each axis from a remote potentiometer or PLC with an analog output, or from the front panel controls (default).

MAGNETIC ARC CONTROL PROBES

MP-1 PROBE

The MP-1 is a single-tip, water-cooled probe that adapts to conventional torches. The MP-1 works well in tight clearances and is primarily used to weave the arc across the seam or to stabilize the arc. On page 10 is Table 3 - MP-1 Magnetic Arc Probe Assembly Specifications and Figure 9 - MP-1 Magnetic Arc Probe Assembly for detailed dimensions and specifications.

MP-100 PROBE

The MP-100 probe incorporates the latest magnetic technologies. Though similar to the MP-1 probe, the new MP-100 probe has a much higher gauss strength and three times the efficiency of the MP-1. The MP-100 does not require water cooling; however, it does allow for optional water cooling. For added convenience and flexibility, it also features a detachable control cable. This single-axis probe adapts to conventional torches. A variety of return rings and tips are available for different configurations. See page 11 is Table 4 - MP-100 Magnetic Arc Probe Assembly Specifications and Figure 10 - MP-100 Magnetic Arc

Porbe Assembly for detailed dimensions and specifications.

MP-2 PROBE

The dual-tip MP-2 slips over a conventional TIG torch and can be used either for cross-seam arc weaving or in-line arc weaving. In-line weave is primarily used in tube mills to preheat the tube, pishing the arc into the direction of travel, giving increased weld travel speeds. See page 12 is Table 5 - MP-2 Magnetic Arc Probe Assembly Specifications and Figure 11 - MP-2 Magnetic Arc Probe Assembly for detailed dimensions and specifications.

MP-22 PROBE

This twin-tip side-mount unit is capable of delivering the full 600 gauss magnetic field to the welding arc area. Though normally used in an air-cooled mode, if necessary, the MP-22 can also be water-cooled. For detailed specifications on the MP-22 probe, see Table 6 - MP-22 Magnetic Arc Probe Assembly Specifications and Figure 12 - MP-22 Magnetic Arc Probe Assembly on page 13.

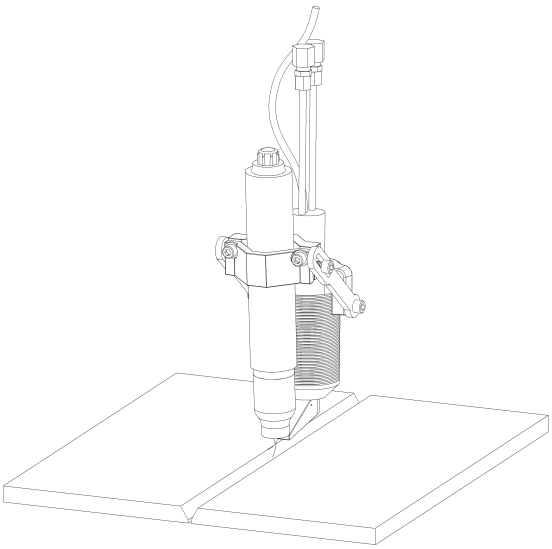

FIGURE 1 - MP-1 AND MP-100 MOUNTING METHOD, CROSS SEAM

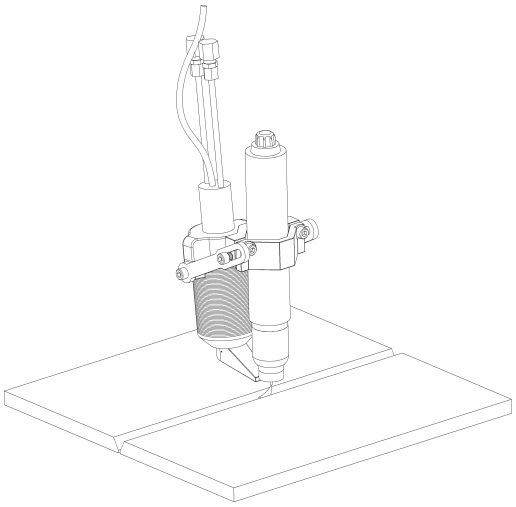

FIGURE 2 - MP-1 AND MP-100 MOUNTING METHOD, ALONG SEAM

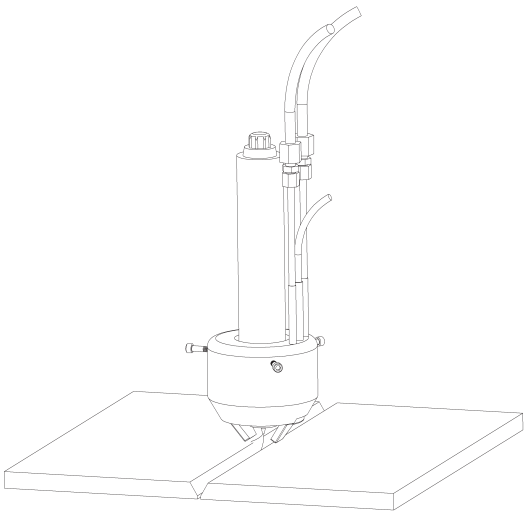

FIGURE 3 - MP-2 MOUNTING METHOD, ALONG SEAM

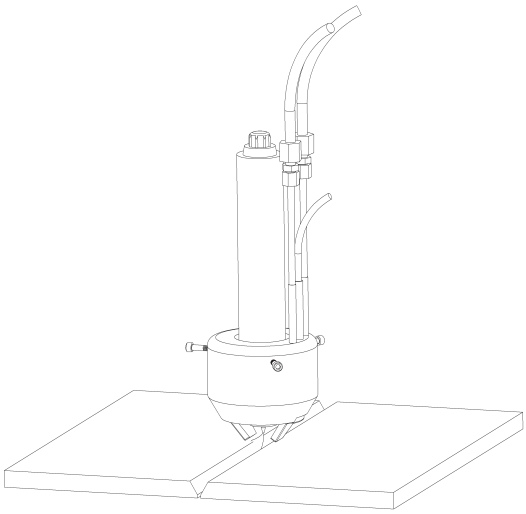

FIGURE 4 - MP-2 MOUNTING METHOD, CROSS SEAM

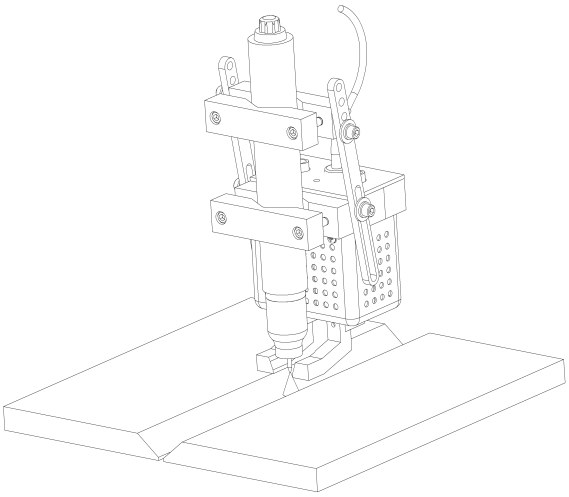

FIGURE 5 - MP-22 MOUNTING METHOD, ALONG SEAM

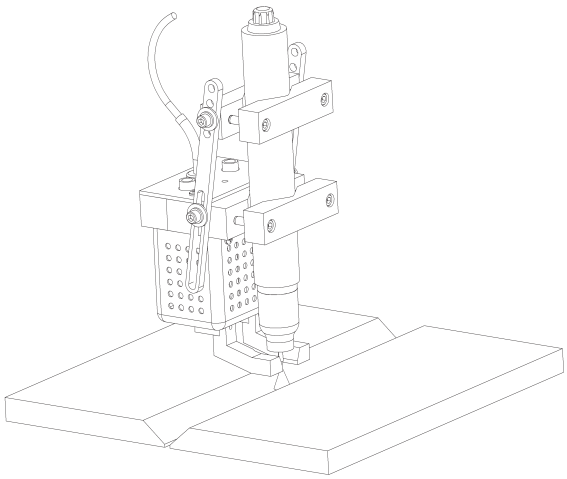

FIGURE 6 - MP-22 MOUNTING METHOD, CROSS SEAM

INSTALLATION

GENERAL SETUP

A standard MA-20 Magnetic Arc Control system is shown in Figure 13 - Interconnection Diagram, with the necessary interconnects shown schematically.

The major parts required for installing this system are listed below. Check all items for damage when unpacking.

System should consist of the following:
- Control Unit
- Probe Assembly
- Remote Interface Cable
- Power Cord
- Operators Manual

OPTIONS AND SPECIALS

Options for the MA-20 System may be purchased from Arc Products. Specials include probe tips, probe tip extensions and extension length cables designed to fit a particular mechanical configuration when the standard tips or cables will not.

The installation of the MA-20 System is very easy and can be accomplished on most automatic or semiautomatic setups within minutes.

CONTROL UNIT LOCATION

The MA-20 Control Unit should be placed in a location which provides easy access to the controls and proper air ventilation for cooling. To allow adequate ventilation, maintain a minimum of 5 inches of unrestricted space between the control unit (sides) and the nearest obstruction. The location should be selected to minimize the amount of dust, dirt, moisture and corrosive vapors the Control Unit will be subjected to. Please see Figure 14 - MA-20 Magnetic Arc Control Mounting Dimensions for mounting hole patterns and other dimensions.

NOTE

Although the control unit requires no other electrical interfacing with any of the users's other equipment, be sure to select the proper input voltage before plugging the unit into the ac power outlet! This unit operates on either 110/220 VAC 50/60 hz power. Be sure the Voltage Selector switch is in the proper position for the power you are using!

The Voltage Selector switch is located on the outside of the control unit near the AC power cord receptacle (Refer to Figure 7 - MA-20 Magnetic Arc Control Unit and Figure 31 - MA-20 Magnetic Arc Control Exploded View). The operator may select the proper input voltage using a small slotted screwdriver. The mounting dimensions of the control unit are shown in Figure 14 - MA-20 Magnetic Arc Control Mounting Dimensions, should the user choose to install the MA-20 on a fixture or control panel.

MAGNETIC ARC PROBE MOUNTING

The MP-1, MP-22, and MP-100 Probes will mount on any machine torch with a body diameter from 1.31 inches to 2 inches. The MP-2 Probe will mount on any machine torch with a body diameter of 1.625 inches or less. (See review the figures and tables on the following pages beginning on page 10 for dimensional references.)

MP-1 & MP-100

- Back off the two socket screws which secure the probe mounting bracket to the torch body.
- Slip the probe over the torch and align the tips approximately even with the gas cup, or bottom of torch. Tighten the 2 screws, then loosen the screws holding the bracket to the probe in order to position the probe on the torch body. (See Figure 2 - MP-1 and MP-100 Mounting Method, Along Seam and Figure 1 - MP-1 and MP-100 Mounting Method, Cross Seam beginning on page 4 for illustrations of probe-to-seam orientation.)

MP-2

The MP-2 probe is a torroidial design probe, where the torch mounts through the center of the probe. To make mounting this probe to a torch easier, torch adapters are available, but are not required to mount the probe to the torch.

- A) Select a suitable adapter for your torch (if necessary).

  Without adaptor: 1.625 in.
  Adapter P/N 1030-0517: 1.500 in.
  Adapter P/N 1026-0582: 1.455 in.
  Adapter P/N 1026-0574: 1.380 in.

- Back off the three socket head cap screws which secure the probe to the torch body.
- Slip the probe over the torch and align the tips approximately even with the gas cup, or bottom of torch. Tighten the three screws while insuring that the probe remains centered on the torch body.

For probe-to-seam orientation, please refer to Figure 3 - MP-2 Mounting Method, Along Seam and Figure 4 - MP-2 Mounting Method, Cross Seam beginning on page 4 for illustrations of this probes probe-to-seam orientation.

MP-22

The MP-22 probe has the strongest magnetic field strength of all of the Magnetic Arc Probes. Under normal conditions, the MP-22 doesn't need water cooling, but water cooling hoses and coolant can be added to the probe during high amperage welding applications or when high amplitude settings are desired. See Figure 5 - MP-22 Mounting Method, Along Seam and Figure 6 - MP-22 Mounting Method, Cross Seam beginning on page 5 for mounting information and Figure 12 - MP-22 Magnetic Arc Probe Assembly on page 13 for additional probe specifications.

The MP-1 and MP-2 probes are water-cooled units and require cooling water (40 psi max.) Be sure to connect the probe to a circulating cooling system before starting operation, as severe damage to the probe may result if the probe is not properly cooled. Once mounting is complete, connect the probe to the MA-20 Control Unit, then connect the control unit to an AC power outlet.

NOTE

Be sure of select the correct input voltage at the Voltage Selector switch matching that which you intend to use before connect the control unit to an AC power outlet.

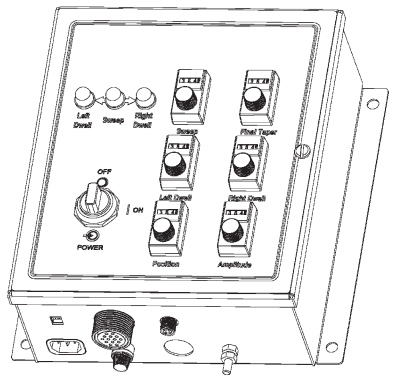

FIGURE 7 - MA-20 MAGNETIC ARC CONTROL UNIT

TABLE 1 - MA-20 MAGNETIC ARC CONTROL SPECIFICATIONS

ITEM	DESCRIPTION	SPECIFICATIONS
Frequency	Oscillating Frequency	1.0 to 50 Hz maximum with Sweep at Zero
Amplitude	Oscillating Width	.25 inches on each side of the weld line (approximate)
Position	Arc Position	.25 inches on each side of the weld line (approximate)
Dwell	Left and Right Arc Dwell Time	100:1 on either side of the desired weld line (continously adjustable)
Sweep	Transition Adjustment between either side	0 to 3 seconds transition adjustment between left/right dwells
Taper	Trail off of Amplitude at the end of the weld cycle	0 to 15 seconds to match downslope time of the welding power source
Controls	Frequency	
	Amplitude	
	Left / Right Dwell	
	Sweep	
	Taper	
	Stabilize / Oscillate Mode DIP Switches	
Input	Power Requirements	90 - 132 VAC / 180 - 264 VAC 50/60 Hz
Control Unit	Enclosure	Standard NEMA Style Sealed enclosure
Probes	MA-20 can be used with these probes	MP-1
		MP-2
		MP-22
		MP-100
Power Cable	Standard Length	8’ (1.8 M)
Remote Interface Cable	Standard Length	10’ (3 M)
Weight	Standard Weight	10 lbs. (4.1 Kg)

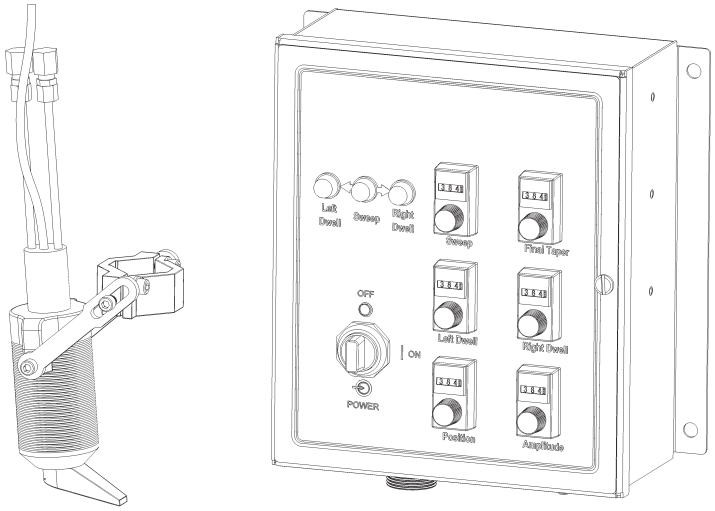

FIGURE 8 - MA-20 MAGNETIC ARC CONTROL SYSTEM COMPONENTS

TABLE 2 - MA-20 MAGNETIC ARC CONTROL SYSTEM COMPONENTS SPECIFICATIONS

ITEM	SPECIFICATION
Control Unit	MA-20 Magnetic Arc Control
Probe Assembly	MP-1, MP-2, MP-22, MP-100 Probes
Cables	Power Cord Assembly
	Remote Interface Cable Assembly
	Probe Cable Assembly (MP-100 only)
Manual	MA-20 Operators and Service Manual

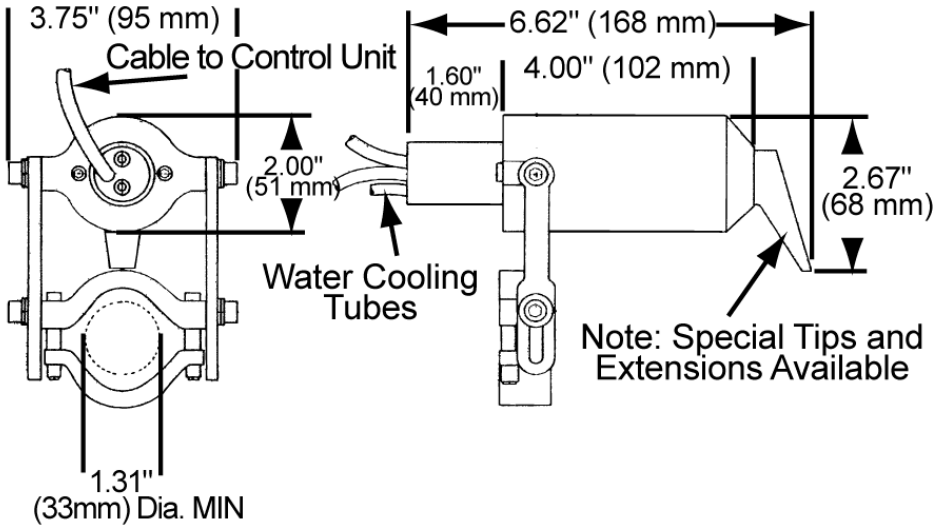

FIGURE 9 - MP-1 MAGNETIC ARC PROBE ASSEMBLY

TABLE 3 - MP-1 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS

ITEM	DESCRIPTION	SPECIFICATION
Weld Current Rating	Arc Welding Amperage is limited due to heat and strength of arc	600 amps 100% duty cycle
Cooling	Liquid cooling of the probe	1 quart or water per minute at 68 degrees F (20 C) with a miximum water pressure of 40 PSI
Ship Weight		5 pounds (2.3Kg)
Cable Length	Control Cable Length	8 feet (2.4M)
Hose Length	Liquid Cooling Hose Length	12’ (3.6M)
Accessories	Tip Extensions	1” Tip Extension (1 required)
		2” Tip Extension (1 required)
		3” Tip Extension (1 required)
		4” Tip Extension (1 required)

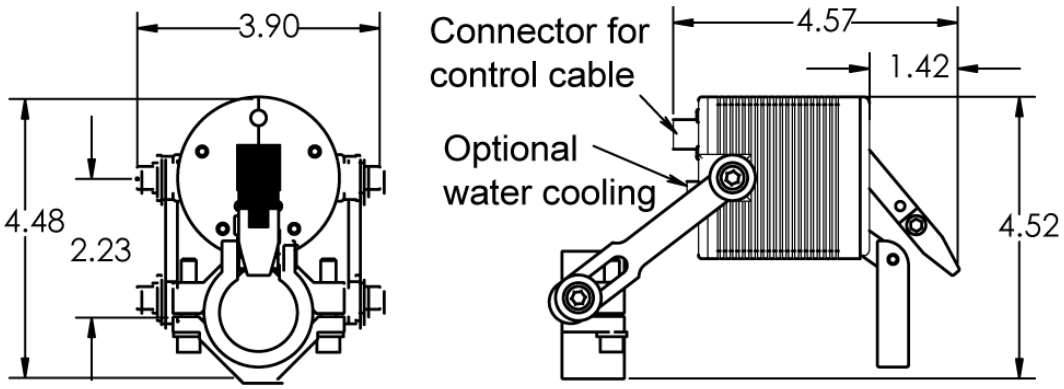

FIGURE 10 - MP-100 MAGNETIC ARC PORBE ASSEMBLY

TABLE 4 - MP-100 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS

ITEM	DESCRIPTION	SPECIFICATION
Weld Current Rating	Arc Welding Amperage is limited due to heat and strength of arc	600 amps 100% duty cycle
Cooling	Liquid cooling of the probe	1 quart or water per minute at 68 degrees F (20 C) with a miximum water pressure of 40 PSI
Ship Weight		5 pounds (2.3Kg)
Cable Length	Control Cable Length	8 feet (2.4M)
Hose Length	Liquid Cooling Hose Length	12' (3.6M) (Optional)
Accessories	Tip Extensions	Consult Factory

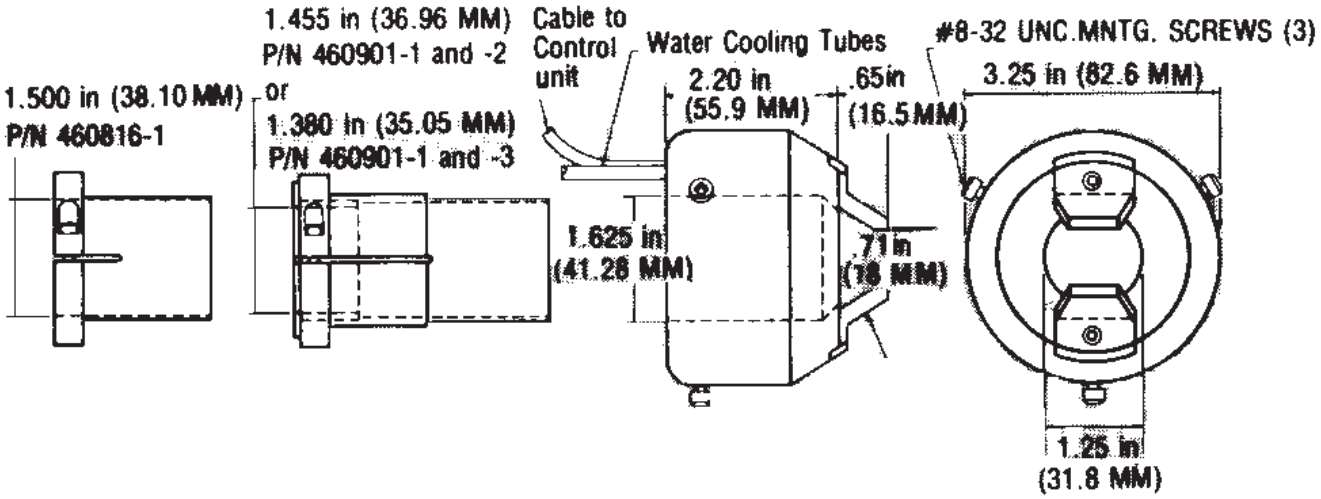

FIGURE 11 - MP-2 MAGNETIC ARC PROBE ASSEMBLY

TABLE 5 - MP-2 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS

ITEM	DESCRIPTION	SPECIFICATION
Weld Current Rating	Arc Welding Amperage is limited due to heat and strength of arc	400 amps 100% duty cycle
Cooling	Liquid cooling of the probe	1 quart or water per minute at 68 degrees F (20 C) with a miximum water pressure of 40 PSI
Ship Weight		4 pounds (2.3Kg)
Cable Length	Control Cable Length	8 feet (2.4M)
Hose Length	Liquid Cooling Hose Length	12' (3.6M)
Accessories	Probe Adaptors	1.380" (35.05 mm) Torch Adaptor
		1.455" (39.96 mm) Torch Adaptor
		1.500" (38.10 mm) Torch Adaptor
	Tip Extensions	1.88" Replacement Extended Length Tips (2 req.)
		2.38" Replacement Extended Length Tips (2 req.)
		2.88" Replacement Extended Length Tips (2 req.)
		3.88" Replacement Extended Length Tips (2 req.)

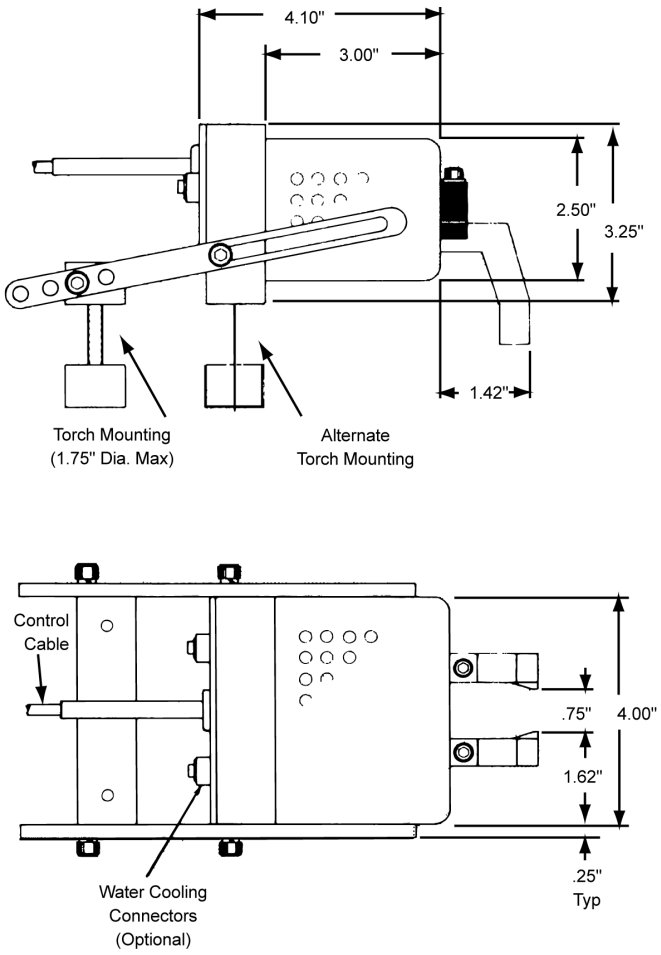

FIGURE 12 - MP-22 MAGNETIC ARC PROBE ASSEMBLY

TABLE 6 - MP-22 MAGNETIC ARC PROBE ASSEMBLY SPECIFICATIONS

ITEM	DESCRIPTION	SPECIFICATION
Weld Current Rating	Arc Welding Amperage is limited due to heat and strength of arc	600 amps 100% duty cycle
Cooling	Liquid cooling of the probe	1 quart or water per minute at 68 degrees F (20 C) with a miximum water pressure of 40 PSI
Ship Weight		6 pounds (2.3Kg)
Cable Length	Control Cable Length	8 feet (2.4M)
Hose Length	Liquid Cooling Hose Length	12’ (3.6M) (Optional)
Accessories	Tip Extensions	1” Tip Extensions (2 req.)
		3” Tip Extensions (2 req.)
		5” Tip Extensions (2 req.)

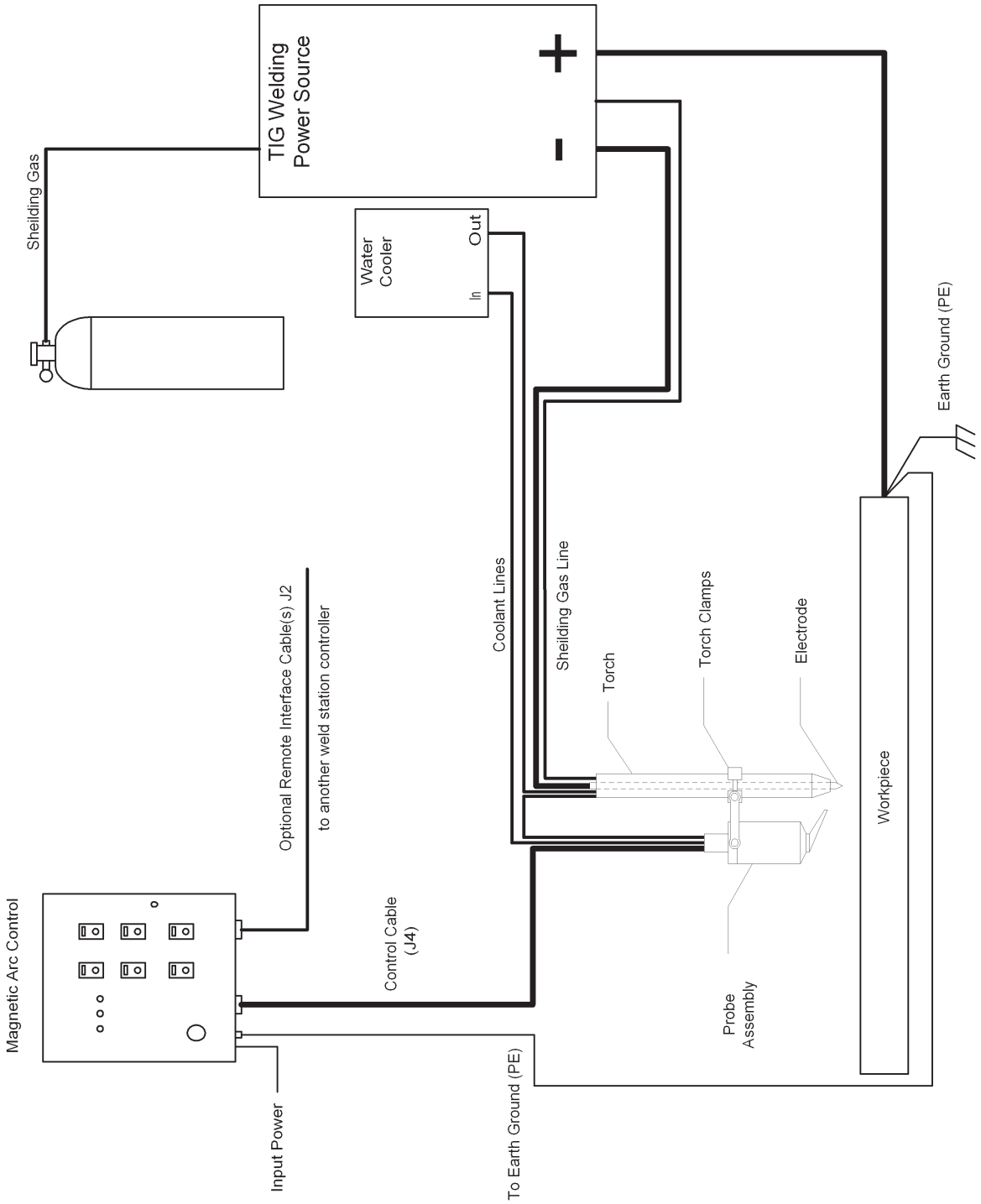

FIGURE 13 - INTERCONNECTION DIAGRAM

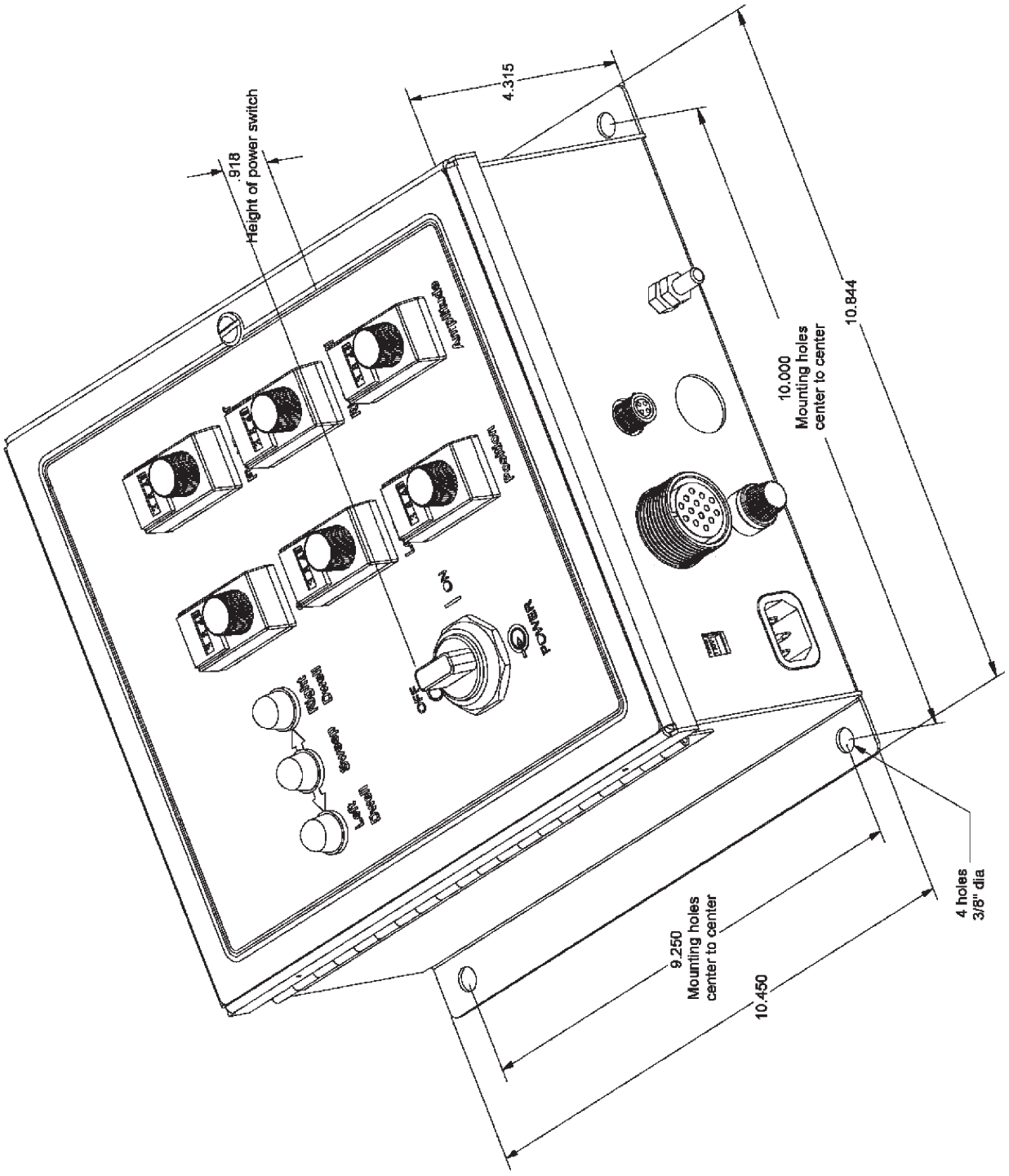

FIGURE 14 - MA-20 MAGNETIC ARC CONTROL MOUNTING DIMENSIONS

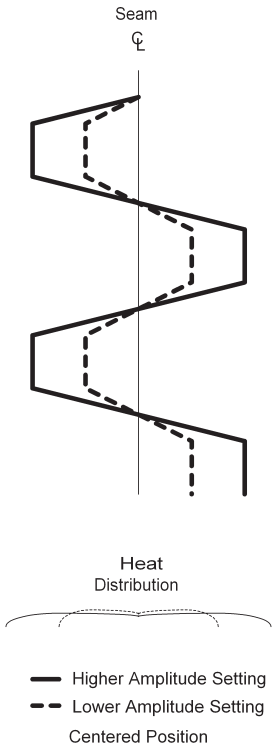

FIGURE 15 - AMPLITUDE SETTINGS

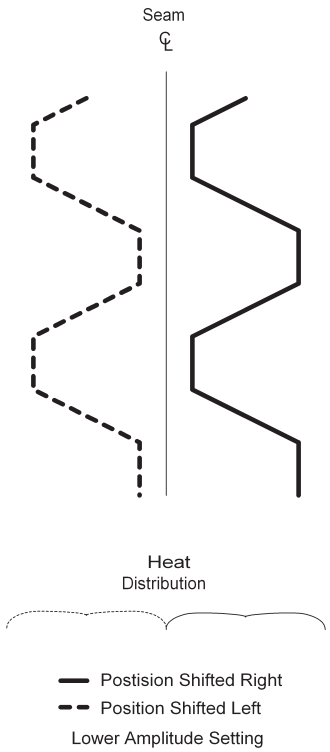

FIGURE 16 - POSITION SETTINGS

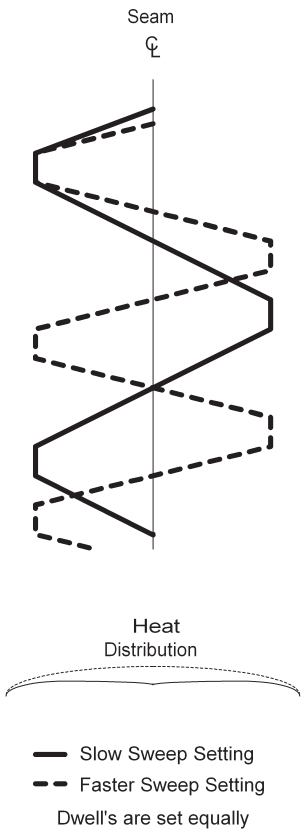

FIGURE 17 - SWEEP SETTINGS

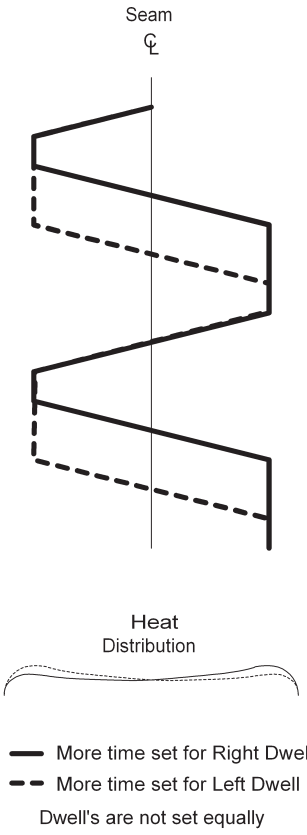

FIGURE 18 - DWELL SETTINGS

OPERATION

GENERAL OPERATIONAL DESCRIPTION

CONTROL FEATURES & FUNCTIONS

To give the operator a better understanding of the MA-20 Magnetic Arc Control System, this section contains information regarding the various features of the Control Unit and illustrations of the various basic weld patterns that can be achieved in operation.

In order to oscillate, the arc the control unit generates alternating currents. These alternating currents can be controlled by 3 functions of the control unit, i.e., Sweep, Left Dwell and Right Dwell. The magnetic field strength is controlled by the Amplitude adjustment. The Position adjustment controls the arc's center-line.

The illustrations of the MA-20 controls, with explanations of their functions, are included to aid the operator in achieving optimum results while operating this system. However, the best way to become familiar with the capabilities of the MA-20 is to strike an arc on a piece of heavy steel and experiment with the arc length, the relationship of the probe tip to the arc, and the effects of the individual control functions.

Remote / Panel Position Control

The operator may control the arc position from a remote potentiometer or PLC with an analog output, or from the front panel controls (default). Remote or Panel Position Control is selected with an internal DIP switch (see Figure 29 - Default Position DIP Switch Settings).

Stabilize / Oscillate

There are two modes for the operation of the Control Unit: the Stabilize mode and the Oscillate mode. The STAB/OSC DIP switch is located on the PC board inside the chassis (see Figure 30 - MA-20 Main Board Layout).

When these switches are in the Oscillate (OSC) position, as illustrated in Figure 23 - Default Osc / Stab DIP Switch Settings, the control will deflect the arc left and right. This will be indicated by the three lamps on the front panel. Each lamp will illuminate alternately, completing one cycle. When the STAB/OSC switch is in the Stabilized (STAB) position, the arc is stabilized. In Stabilize mode, the operator can use the Position control to preheat, post-heat, or concentrate the arc heat in the center in relation to torch or workpiece movement.

Sweep

The Sweep function controls the speed in which the magnetic field changes from the left dwell position to the right dwell position. See Figure 17 - Sweep Settings on page 16. Generally, a fast welding travel speed requires higher frequency oscillation or a lower Sweep Dial Setting.

Left & Right Dwell

The Left and Right Dwell functions of the control unit control the amount of time the arc will remain on either side during oscillation. See Figure 18 - Dwell Settings on page 16. The settings ar independently adjustable.

Amplitude

The Amplitude dial adjusts the gauss strength of the magnetic field, see Figure 15 - Amplitude Settings on page 16. The effect of the magnetic field on the deflection of the arc is related to the length of the arc, the type of material being welded, the joint configuration, and the welding process being used. The proximity of the probe tip to the arc also greatly influences the degree to which the magnetic field will deflect the arc. The optimum amplitude control setting in a given application can span a relatively broad range. It is best to utilize the lowest amplitude setting possible, as high gauss strength can result in arc instability.

Position

Arc positioning provides a means of offsetting the arc path relative to the center line of the torch. This is accomplished by a controllable current which is applied to the probe, creating a constant magnetic field which displaces the arc. The arc Position dial controls this displacement, see Figure 16 - Position Settings on page 16.

In the Stabilize mode, Position can be used to stabilize the arc and control it without oscillation, and in the Oscillate mode Position can be used to offset the oscillating pattern. The distance the arc can be displaced is dependent on the same factors as the Amplitude settings. If high amplitude and large offsets are used, distortion of the magnetic field is likely and instability will result.

Final Taper

The Taper function is a new feature in Magnetic Arc Control Systems. This feature sets the amount of time to decrease the Amplitude setting from its current value to zero in order to perform a better downslope function in coordination with the welding power source or controller. Referring to Figure 19 - Taper Function, the Taper feature is only used with a remote input to feather out the weld pool at the end of the weld.

The Taper setting should be slightly less than the actual downslope time of the welding amperage to be sure the oscillation has stopped completely prior the arc extinguishing. This Taper Feature is primarily useful in applications when downslope is used. As the welding amperage decreases during downslope, the arc becomes weaker and easier to move (or oscillate) by the magnetic arc control system. If the magnetic field strength does not decrease along with the amperage, the arc could be blown out by the magnetic arc control system, especially on lower amperage arcs and/or when higher amplitude settings on the magnetic arc control unit are used.

The Taper input can also be used to start and stop the oscillation when needed. If only one output is available from a controller and remote start / stop is desired, use the Taper input to Start and Stop arc oscillation. The Taper input must be maintained to keep the magnetic arc control from oscillating the arc. To begin oscillating again, simply remove the input to the magnetic arc control unit. See Figure 22 - Default Taper DIP Switch Settings for proper configuration. Refer also to Figure 25 - Remote N.O. Taper Interface on page 21 for proper remote interface cable wiring. When the Taper Signal is used as a Remote Start input in a Normally Open (N.O.) configuration, the control unit will oscillate the arc whenever there is not a closure between Pins D and A. When a closure between Pins D and A is made, the Taper Feature will be enabled and the magnetic field strength generated by the controller will begin to decrease. The Taper adjustment will set the time to reach zero or no magnetic field strength. At the end of the Taper Time, the magnetic oscillation will stop. Arc oscillation will not begin again until the Taper input is removed. Once the Taper input has been removed, the arc will begin to oscillate again at the Amplitude adjustment setting.

For wiring instructions on the Remote Taper signal, please review the schematic in Figure 48 - MA-20 Magnetic Arc Control Interface Cable Schematic on page 51 for more details.

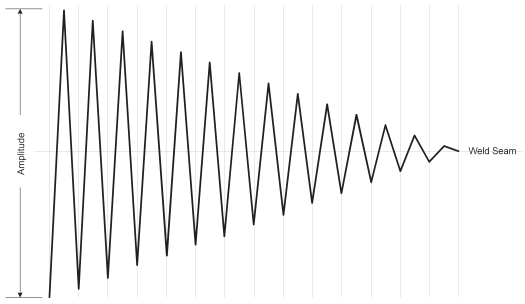

FIGURE 19 - TAPER FUNCTION

Remote Start

The magnetic arc control is equipped with a Remote Start (and Stop) input to control the arc oscillation. For proper operation of this feature, the Inhibit DIP Switches must be configured for your start signal.

There are two Start Signal Modes of operation, i.e., Signal Normally Open (N.O.) and Signal Normally Closed (N.C.). The Inhibit DIP Switches must be configured correctly if a signal is not being used and operation is simply by powering up the control or to match the signal input being used.

If no input is being used and/or the unit is initially being setup, the DIP switches must be configured as in Figure 20 - Default Inhibit DIP Switch Settings. Only one switch of the DIP switch should be depressed to the closed position (away from the word “OPEN”). The other switch of the DIP switch should be depressed in the opposite position.

WARNING

If the Taper and Inhibit DIP switches are not cofigured correctly to match your application the system will not create a magnetic field to oscillate the arc.

TABLE 7 - REMOTE START N.O. INHIBIT SETTINGS

DIP SWITCH NAME	SWITCH #	POSITION
INHIBIT	1	CLOSED
	2	OPEN
TAPER	1	CLOSED
	2	OPEN

Normally Open Start

To use the Remote Start feature (not the Taper feature) with a Normally Open Start Signal that will close when the arc is to oscillate, there are two sets of DIP Switches that need to be configured in addition to the remote interface wiring. The Inhibit and Taper DIP switches must be set for Normally Open positions. See Table 7 - Remote Start N.O. Inhibit Settings on page 18.

The Remote Start Input (also known as Inhibit) must also be wired correctly on the remote interface cable. Figure 28 - Remote N.O. Inhibit Interface shows the proper wiring for N.O. Configuration. Also Figure 20 - Default Inhibit DIP Switch Settings illustrate the proper DIP settings.

When the Remote Start (Inhibit) Signal is used in a Normally Open (N.O.) configuration, the control unit will oscillate the arc whenever there is a closure between Pins B and A. When a closure between Pins B and A is made, the Remote Start will be enabled and arc oscillation will begin. When the closure between Pins B and A is removed, arc oscillation will stop and will not begin again until the closure is made again. Once the Remote Start input has been closed, the arc will begin to oscillate again at the Amplitude adjustment setting.

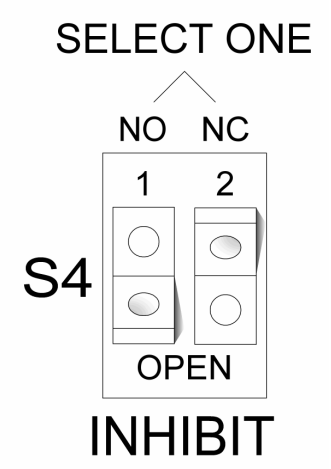

FIGURE 20 - DEFAULT INHIBIT DIP SWITCH SETTINGS

Normally Closed Start

To use the Remote Start feature (not the Taper feature) with a Normally Closed Start Signal that will open when the arc is to oscillate, there are two sets of DIP Switches that need to be configured in addition to the remote interface wiring. The Inhibit DIP switch must be set for Normally Closed position and the Taper DIP switch must be set for the Normally Open positon. See Table 8 - Remote Start N.C. Inhibit Settings on page 19.

The Remote Start Input (also known as Inhibit) must also be wired correctly on the remote interface cable. Figure 27 - Remote N.C. Inhibit Interface shows the proper wiring for N.C. configuration. Also Figure 21 - Inhibit NC DIP Switch Settings illustrate the proper DIP settings.

When the Remote Start Signal is used in a Normally Closed (N.C.) configuration, the control unit will oscillate the arc whenever there is a not a closure between Pins I and A. When a closure between Pins I and A is made, arc oscillation will stop. Arc oscillation will not begin again until the Remote Start input is removed. Once the Remote Start input has been removed, the arc will begin to oscillate again at the Amplitude adjustment setting.

TABLE 8 - REMOTE START N.C. INHIBIT SETTINGS

DIP SWITCH NAME	SWITCH #	POSITION
INHIBIT	1	OPEN
	2	CLOSED
TAPER	1	CLOSED
	2	OPEN

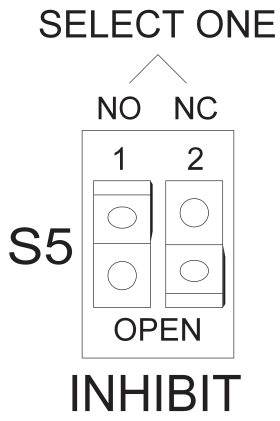

FIGURE 21 - INHIBIT NC DIP SWITCH SETTINGS

Normally Open Start Using Taper

To Remote Start the magnetic arc control using the Taper feature with a Normally Open Signal that will close when the arc is to oscillate, there are two sets of DIP Switches that need to be configured in addition to the remote interface wiring. The Inhibit and Taper DIP switches must be set for the Normally Open positions. See Table 10 - Remote Taper N.O. Settings on page 20.

The Taper input must be maintained to keep the magnetic arc control from oscillating the arc. To begin oscillating again, simply remove the input to the magnetic arc control unit. See Figure 22 - Default Taper DIP Switch Settings for proper configuration. Refer also to Figure 25 - Remote N.O. Taper Interface on page 21 for proper remote interface cable wiring.

When the Taper Signal is used as a Remote Start input in a Normally Open (N.O.) configuration, the control unit will oscillate the arc whenever there is not a closure between Pins D and A. When a closure be-

tween Pins D and A is made, the Taper Feature will be enabled and the magnetic field strength generated by the controller will begin to decrease. The Taper adjustment will set the time to reach zero or no magnetic field strength. At the end of the Taper Time, the magnetic oscillation will stop. Arc oscillation will not begin again until the Taper input is removed. Once the Taper input has been removed, the arc will begin to oscillate again at the Amplitude adjustment setting.

TABLE 10 - REMOTE TAPER N.O. SETTINGS

DIP SWITCH NAME	SWITCH #	POSITION
INHIBIT	1	CLOSED
	2	OPEN
TAPER	1	CLOSED
	2	OPEN

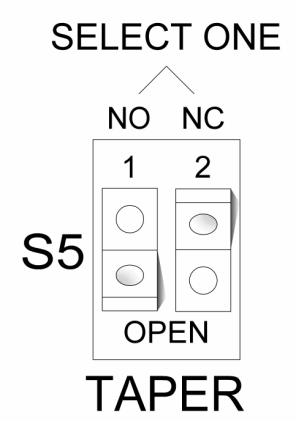

FIGURE 22 - DEFAULT TAPER DIP SWITCH SETTINGS

Normally Closed Start Using Taper

To Remote Start the magnetic arc control using the Taper feature with a Normally Closed Signal that will remain closed when the arc is to oscillate, there are two sets of DIP Switches that need to be configured in addition to the remote interface wiring. The Inhibit DIP switch must be set for Normally Open position and the Taper DIP switch must be set for the Normally Closed positon. See Table 9 - Remote Taper N.C. Settings on page 20.

The Taper input must be maintained to keep the magnetic arc control oscillating the arc. To enable the Taper Feature, simply remove the input to the magnetic arc control unit. See Figure 24 - Taper NC DIP Switch Settings for proper DIP Switch Seetings. Refer also to Figure 26 - Remote N.C. Taper Interface on page 22 for proper remote interface cable wiring.

TABLE 9 - REMOTE TAPER N.C. SETTINGS

DIP SWITCH NAME	SWITCH #	POSITION
INHIBIT	1	CLOSED
	2	OPEN
TAPER	1	OPEN
	2	CLOSED

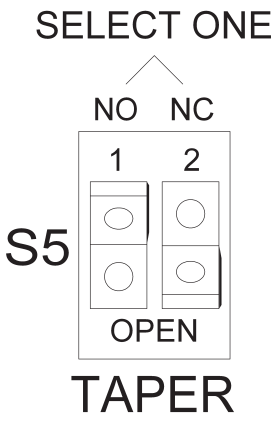

FIGURE 24 - TAPER NC DIP SWITCH SETTINGS

When the Taper Signal is used as a Remote Start input in a Normally Closed (N.C.) configuration, the control unit will oscillate the arc whenever there is a closure between Pins J and A. When a closure between Pins J and A is removed, the Taper Feature will

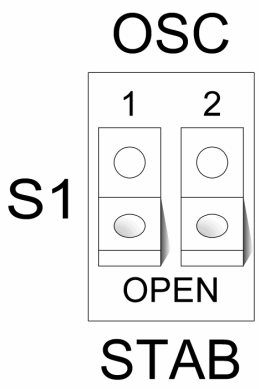

FIGURE 23 - DEFAULT OSC / STAB DIP SWITCH SETTINGS

be enabled and the magnetic field strength generated by the controller will begin to decrease. The Taper adjustment will set the time to reach zero or no magnetic field strength. At the end of the Taper Time, the magnetic oscillation will stop. Arc oscillation will not begin again until the N.C. Taper closure is made. Once the Taper input has been made, the arc will begin to oscillate again at the Amplitude adjustment setting.

INSTALLATION

Once the MA-20 system has been properly installed and the operator has familiarized himself with the unit functions, we recommend that the operator set up a test block, strike an arc and then experiment with the MA-20 controls to get a good feel for the equipment.

- With the power Off, set the Sweep and Amplitude controls to their fully counter clockwise positions (”000” on the dial) and set the Position control at its center position (”500” on the dial). Set both the Left and Right Dwell controls to about 1 second (”300” on the dial). Open the controller door and find the STAB/OSC DIP switch on the main board, see Figure 30 - MA-20 Main Board Layout. Set the STAB/OSC switch in the Oscillate position.
- Strike an arc, allow it to stabilize, then turn On the MA-20 Control Unit. At this point, the operator will not see any significant change in the arc action, but if you look at the 3 red LED indicator lamps on the front panel of the control unit, you will notice they are sequencing, completing one cycle in roughly two seconds.
- With the arc established, adjust the Position control to position the arc directly below the Torch (tungsten). This adjustments offsets the position of the arc and makes up for the probe mechanical mounting errors. See Figure 16 - Position Settings on page 16 to review the controls function.
- Now, turn the Amplitude control clockwise to approximately mid-range of its settings (”500” on the dial). The arc will now deflect left to right. The Figure 15 - Amplitude Settings on page 16 illustrate the function of the Amplitude control.
- As you turn the Sweep control clockwise, you will also notice the arc oscillation cycle decreasing in speed, because we have added time to the left to right dwell transistions and vice-versa. See Figure 17 - Sweep Settings and Figure 18 - Dwell Settings on pages 16 and 16, respectively, for visual explanations of these functions.
- When the STAB/OSC switch is placed in the STAB position, the arc is stabilized. This feature allows for preheating, post-heating, or center heating optimizing.
- Use the Position control to determine the placement of the arc in relation to the torch and seam positions.

NOTE

The preceding control descriptions are written with respect to the probe being installed as described in the installation section of this manual, with the Cross Seam mounting method.

Additional adjustments may be necessary to achieve the desired weld bead penetration and profile. Dwell and Sweep controls are the primary adjustments to change the weld bead profile. Position and Amplitude are primarily the adjustments to control penetration. However, all control functions of the Magnetic Arc Control System interact slightly with each other and on the weld bead profile, penetration, etc. Working on a test block is the best way to gain experience and understanding of the interaction between the controls and the weld bead.

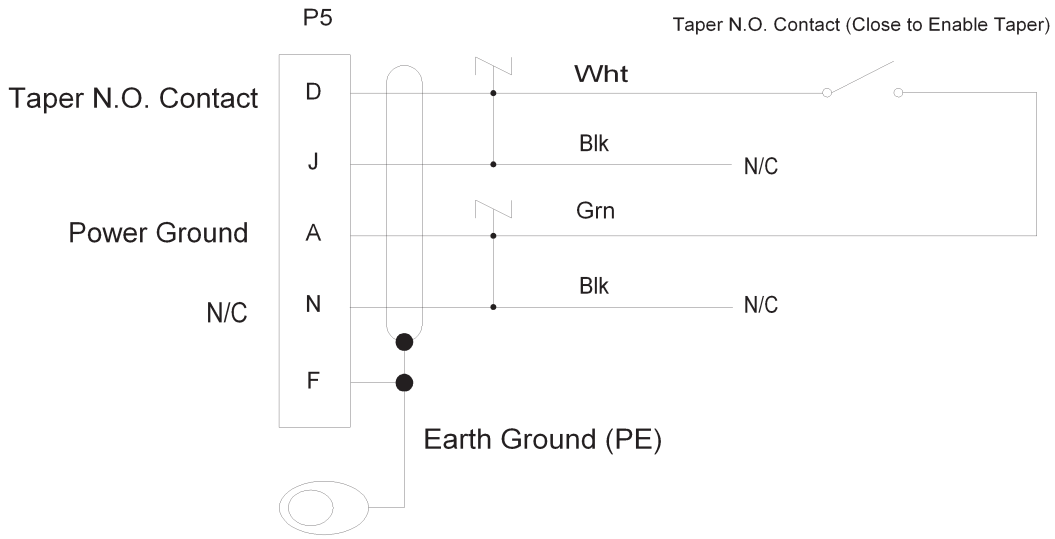

FIGURE 25 - REMOTE N.O. TAPER INTERFACE

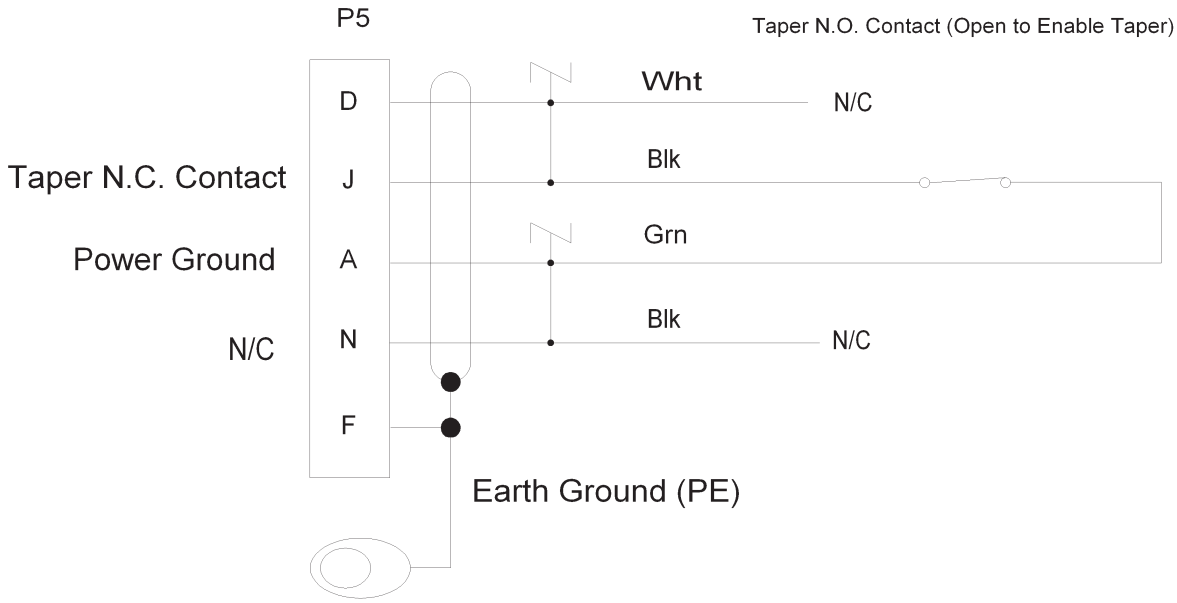

FIGURE 26 - REMOTE N.C. TAPER INTERFACE

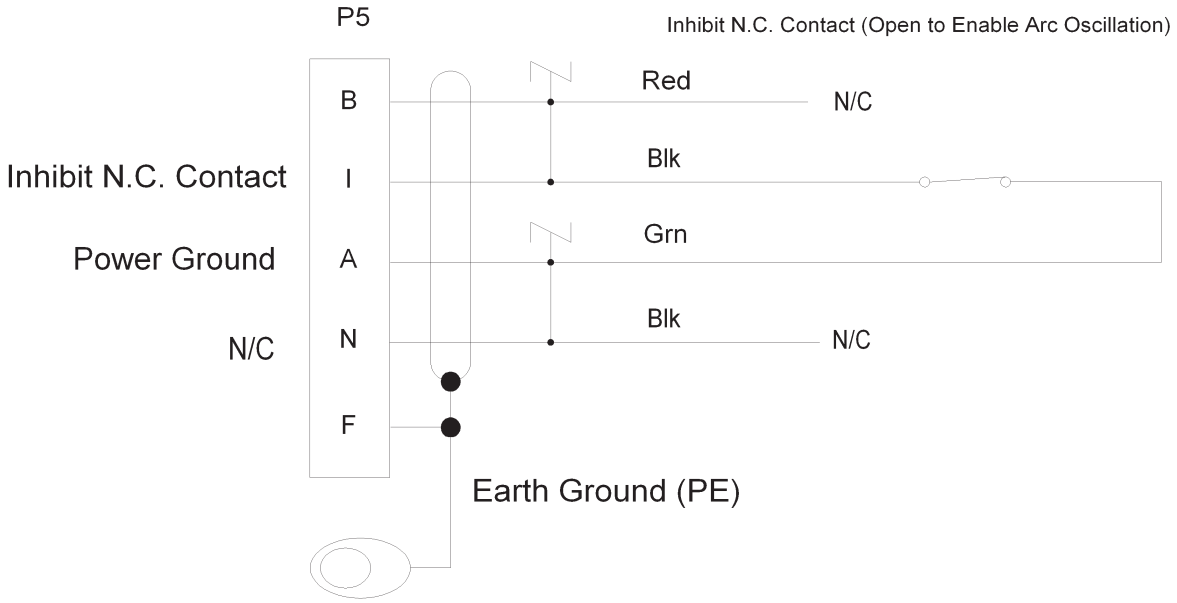

FIGURE 27 - REMOTE N.C. INHIBIT INTERFACE

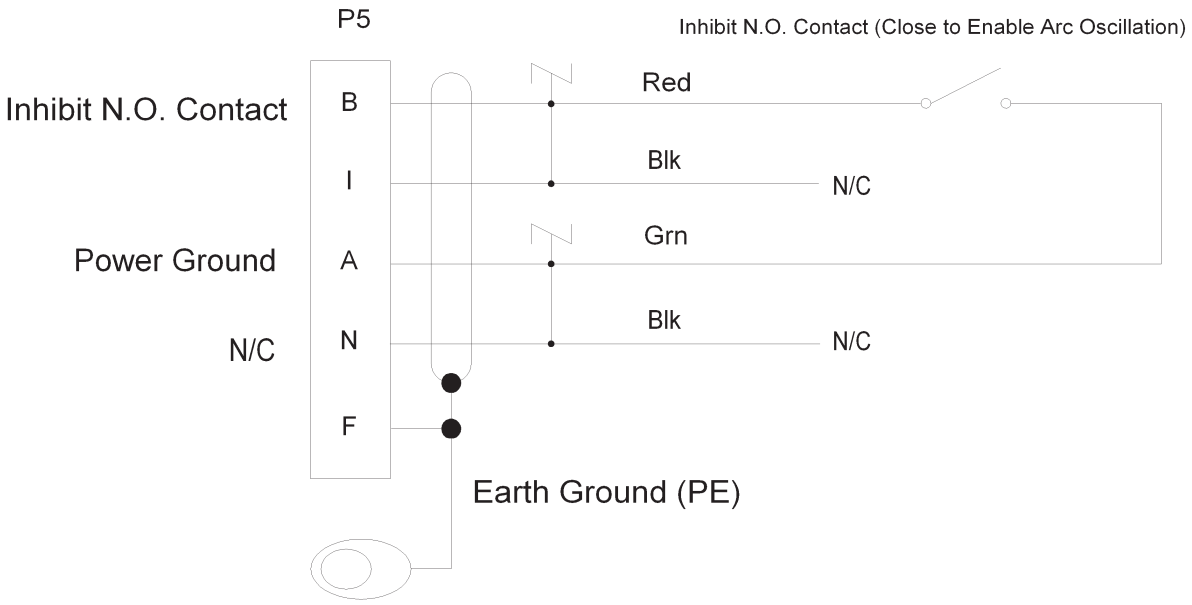

FIGURE 28 - REMOTE N.O. INHIBIT INTERFACE

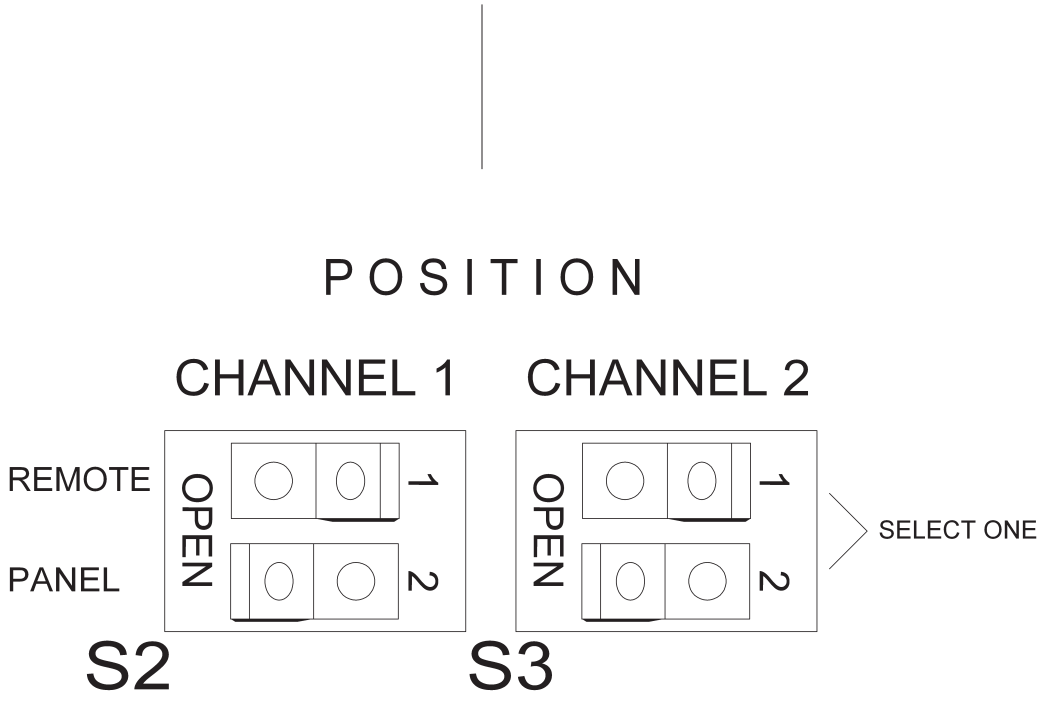

FIGURE 29 - DEFAULT POSITION DIP SWITCH SETTINGS

MAINTENANCE

MAINTENANCE REQUIREMENTS

NOTE

This section contains preventative maintenance suggestions only. Should repair of the MA-20 system become necessary, please call Arc Products Customer Service at 1-800-770-0063 for troubleshooting information and assistance.

CAUTION

All repairs should be performed by qualified service personnel only!

CONTROL UNIT

The MA-20 control unit is factory calibrated and requires no periodic adjustments by the operator or maintenance technician. The unit is cooled by heat convection to the case, which keeps the inside of the unit free from dust and dirt buildup on the circuitry. We recommend periodic visual inspection of the unit; checking for loose connections, etc.

The best preventative measure that can be taken is to keep the enclosure closed tightly.

CAUTION

Do not operate the unit with the cover open and always remove power to the unit before opening to check inside.

PROBES ASSEMBLIES

The MP-1 and MP-2 probes are water-cooled and should never be operated without the coolant being circulated by a cooling source/water cooler. The water hoses are rated for 40 psi maximum. These ratings should not be exceeded, as leakage or bursting of the water hoses will result. Remove any slag buildup from the probe tips frequently, as a loss in the probe's effectiveness to control the arc may result if slag is allowed to accumulate.

CABLE ASSEMBLY

Maintenance of the cable assemblies is to periodically remove dust, soot, metal particles, slag, etc., from the cable’s insulation and checking for cracking in the insulation, sharp bends in the cable at the connectors. Also, check to be sure the connectors are tightened and seated correctly in their mating receptacles.

Repair of the cable assemblies is limited to replacement of defective parts. A wiring diagram of the cable assemblies is included for troubleshooting purposes (see the Schematics and Block Diagrams Section beginning on page 48).

PREVENTIVE MAINTENANCE SCHEDULE

The following schedule is provided to assist in preforming timely maintenance to the system to maintain optimum performance.

Monthly Maintenance

Probe Assemblies

Proper Function

Cable connectors and strain reliefs should be tight and they should be properly seated in their mating receptacles.

Test

Clean slag, dirt and spatter from probe and tip assembly. Verify that the probe creates a magnetic field at the tip.

Quarterly Maintenance

Semi Annual Maintenance

Control Unit Assembly

Be sure the control unit is turned off and unplugged. Using clean, dry air, blow out dust from the inside of the control unit, if any exists. Remember the best preventive maintenance to take is to keep the control enclosure tightly closed.

Be sure all other connections in the control unit are seated firmly in their receptacles and reconnect the power cord to an electrical outlet. Turn power on and check for proper operation.

DRAWING AND PARTS LIST

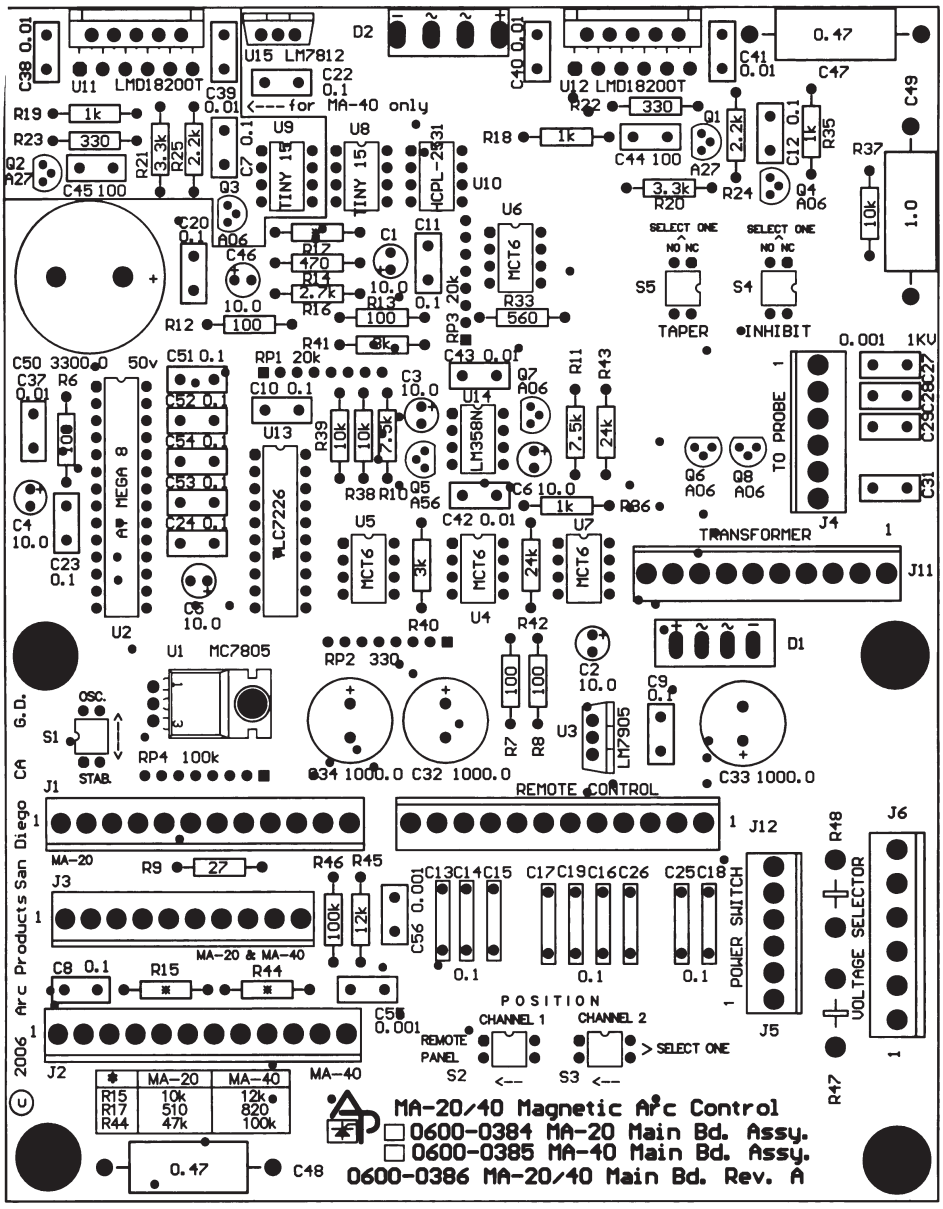

FIGURE 30 - MA-20 MAIN BOARD LAYOUT

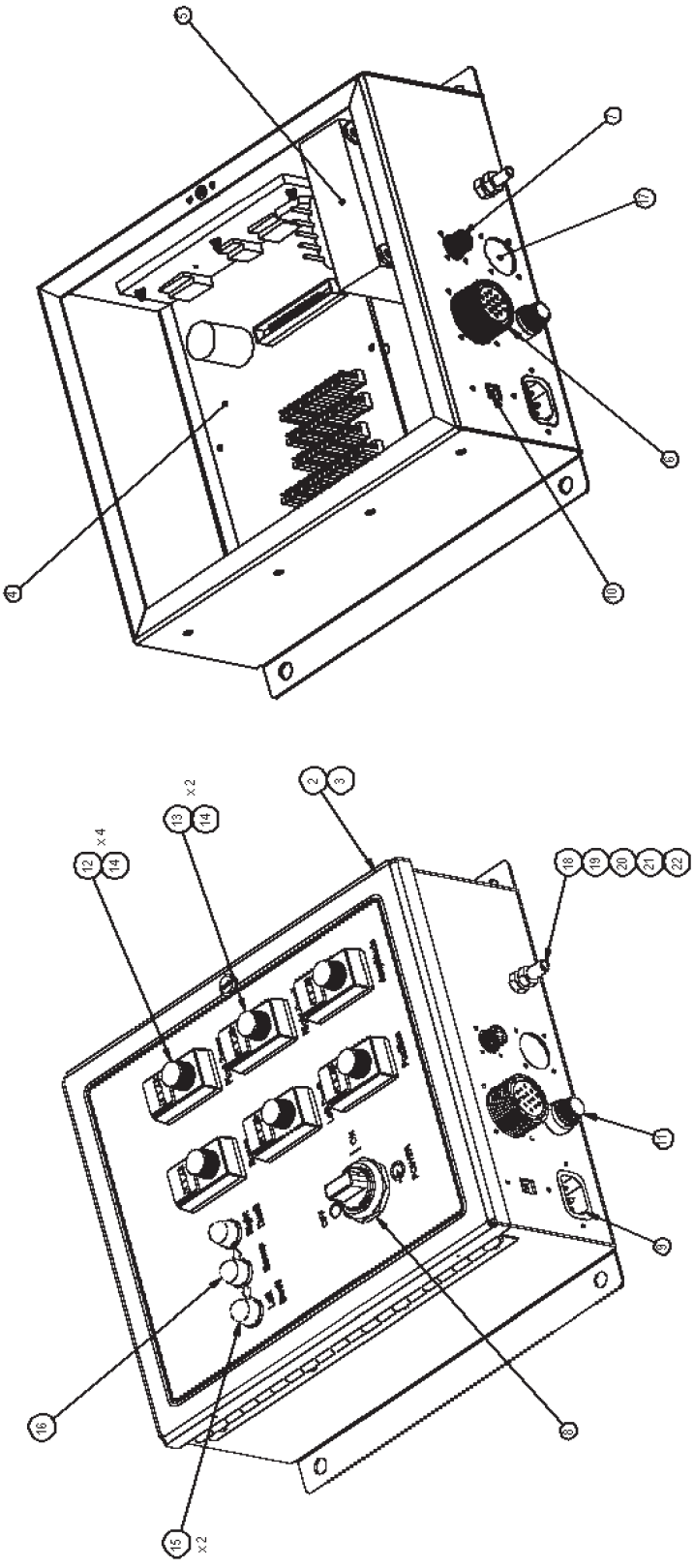

FIGURE 31 - MA-20 MAGNETIC ARC CONTROL EXPLODED VIEW

TABLE 11 - MA-20 MAGNETIC ARC CONTROL PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	0600-0436	MA-20/40 CHASSIS W/PEMS
2	1.000	EA	0600-0437	MA-20/40 DOOR
3	1.000	EA	0600-0438	MA-20 FACE PLATE
4	1.000	EA	0600-0384	MA-20 MAIN BOARD ASSY
5	1.000	EA	0600-0463	MA-20/40 TRANSFORMER ASSEMBLY
6	1.000	EA	0600-0464	MA-20/40 RMT ITFC CONN HARNESS
7	1.000	EA	0600-0465	MA-20 PROBE CONN HARNESS
8	1.000	EA	0600-0371	POWER SWITCH ASSEMBLY
9	1.000	EA	2120-0123	FILTER RFI-PWR LINE 3 AMP
10	1.000	EA	920035-001	SLIDE SW 2 POS LINE VOLT SEL
11	1.000	EA	2120-0107	HOLDER FUSE (3 AG SOLDER)
12	4.000	EA	903009-001	POT 10 TURN PANEL MOUNT-10K
13	2.000	EA	903009-002	POT 10 TURN PANEL MOUNT-1K
14	6.000	EA	940010-001	PRECISION MULTIDIAL
15	2.000	EA	941006-008	LED INDICATOR RED 12VDC
16	1.000	EA	941006-009	LED INDICATOR YELLOW
17	1.000	EA	0600-0440	MA-20 6 PIN COVER
18	1.000	EA	970039-614	SCR 1/4-20X1.00 H SBZ G8
19	2.000	EA	974004-006	WSR F 1/4 .734X.312X.065 SBZ
20	2.000	EA	974010-006	WSR SL 1/4.489X.263X.062 SBZ
21	1.000	EA	974011-018	WSR ITA 1/4 .478X.267X.028 SBZ
22	2.000	EA	972000-006	NUT 1/4-20 H SBZ

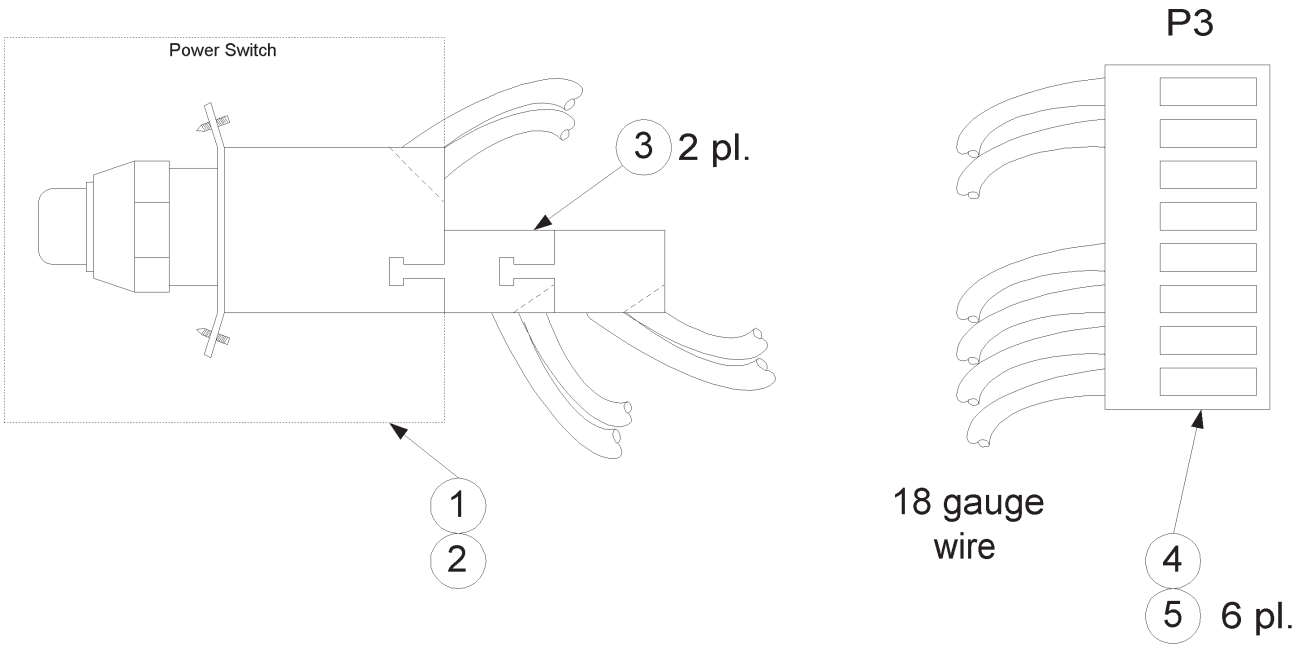

FIGURE 32 - POWER SWITCH ASSEMBLY EXPLODED VIEW

TABLE 12 - POWER SWITCH ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	2066-0171	SWITCH SELECT 1-3/16 RED
4	1.000	EA	2208-0181	CONN RECT PLUG (8CKT)
5	6.000	EA	2212-0018	TERMINAL CRMP MOLEX 18-20 .156
6	5.000	EA	979001-001	CABLE TIE .75 BUNDLE DIA

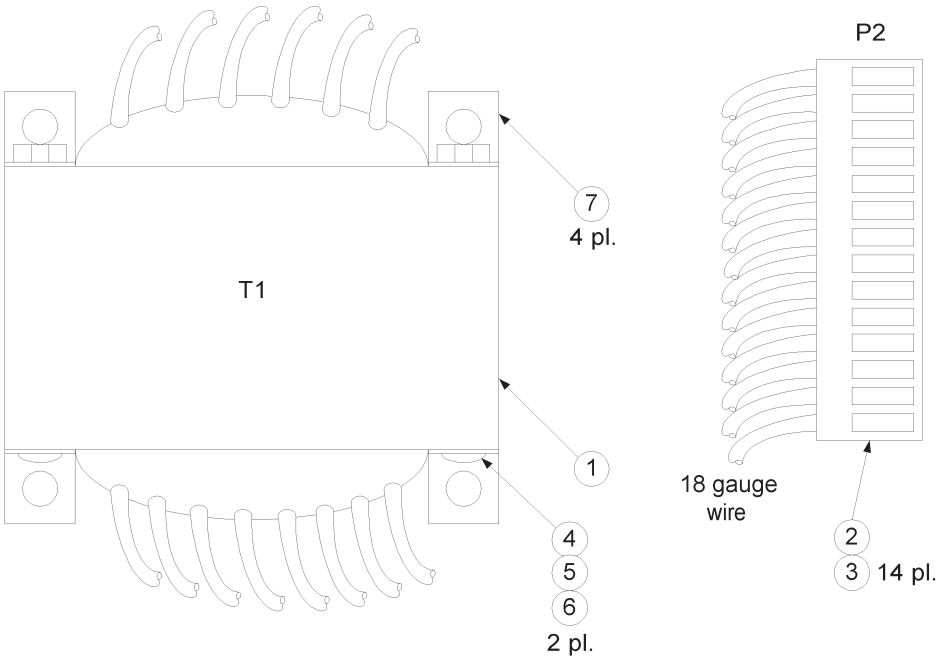

FIGURE 33 - TRANSFORMER ASSEMBLY EXPLODED VIEW

TABLE 13 - TRANSFORMER ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	1037-0063	TRANSFORMER-DUAL PRI DUAL SEC
2	1.000	EA	2208-0199	CONN RECT PLUG (10CKT)
3	10.000	EA	2212-0018	TERMINAL CRMP MOLEX 18-20 .156
4	2.000	EA	970000-426	SCR 8-32X2.50 CR1P SBZ
5	2.000	EA	972001-004	NUT 8-32 FH SBZ SL GB
6	2.000	EA	974010-004	WSR SL #8.293X.175X.040 SBZ

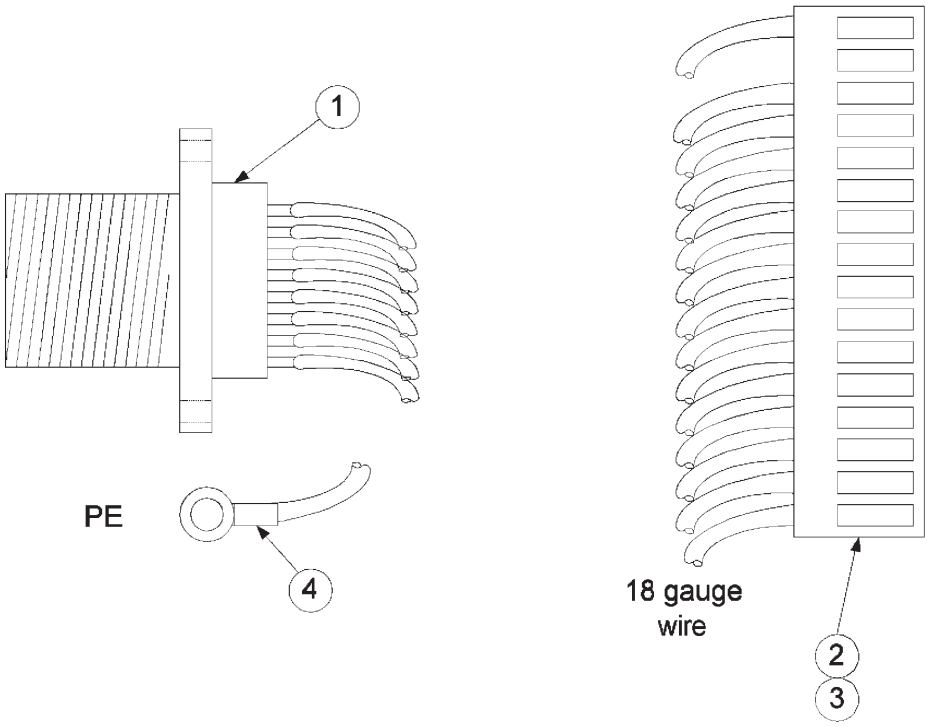

FIGURE 34 - PROBE CABLE HARNESS EXPLODED VIEW

TABLE 14 - PROBE CABLE HARNESS PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	2200-0527	CONN CIRC BOX RCPT 8-4S
2	1.000	EA	2208-0091	CONN RECT PLUG (6CKT)
3	3.000	EA	2212-0018	TERMINAL CRMP MOLEX 18-20 .156

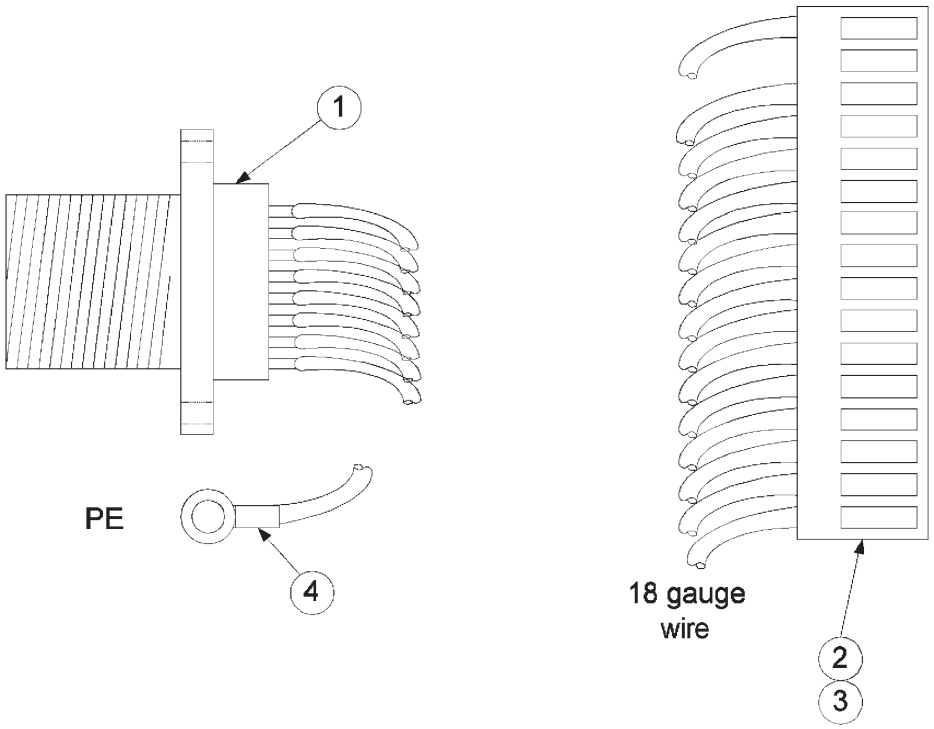

FIGURE 35 - REMOTE INTERFACE CABLE HARNESS EXPLODED VIEW

TABLE 15 - REMOTE INTERFACE CABLE HARNESS PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	930014-001	CONN CIRC BOX RCPT 20-27S
2	1.000	EA	2208-0202	CONN RECT PLUG (12CKT)
3	12.000	EA	2212-0018	TERMINAL CRMP MOLEX 18-20 .156
4	1.000	EA	2340-0588	TERM RING INSUL #6 X .92 LG
5	3.000	EA	979001-001	CABLE TIE .75 BUNDLE DIA

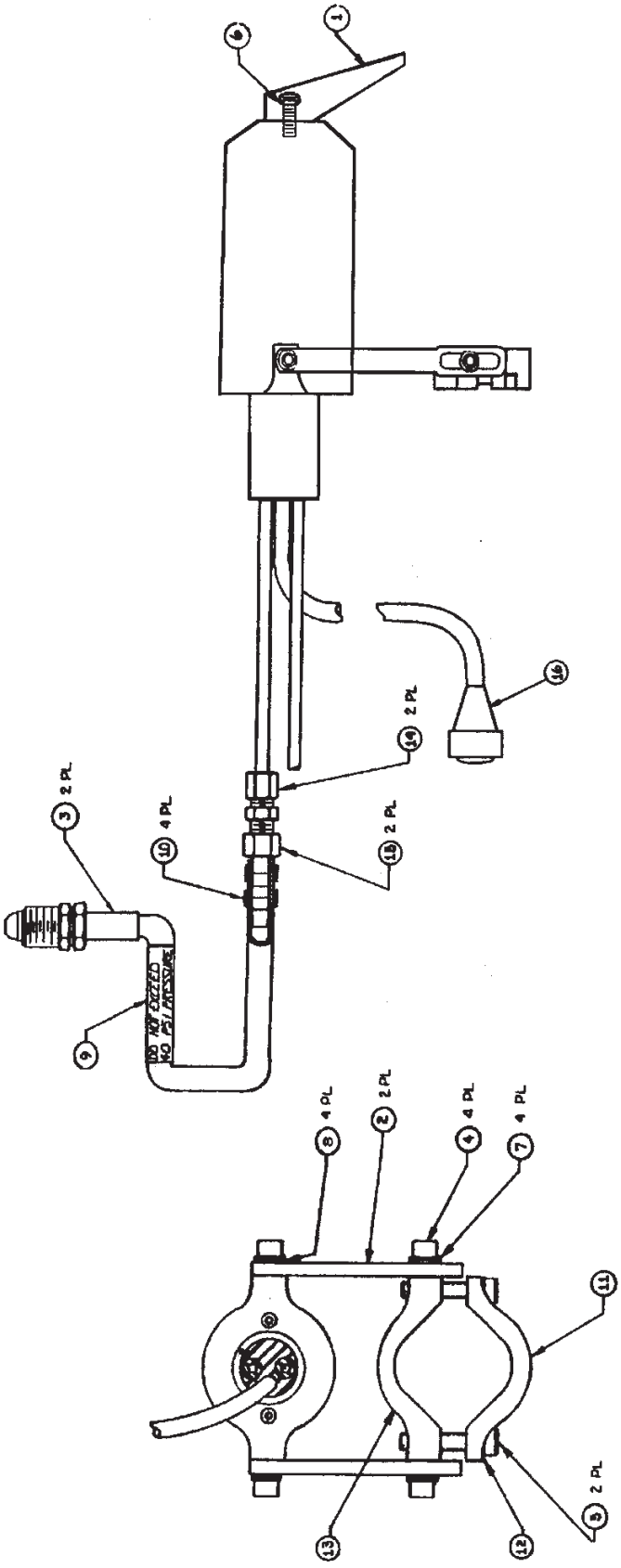

FIGURE 36 - MP-1 MAGNETIC ARC PROBE EXPLODED VIEW

TABLE 16 - MP-1 MAGNETIC ARC PROBE PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	1030-0096	TIP 4604 PROBE
2	2.000	EA	1030-0100	LINK MOUNTING CLAMP
3	2.000	EA	2380-0161	ASSY WATER HOSE - 12FT
4	4.000	EA	970015-608	SCR 1/4-20X.62 HSC SBZ
6	1.000	EA	970015-504	SCR 10-32X.38 HSC SBZ
7	4.000	EA	974010-006	WSR SL 1/4.489X.263X.062 SBZ
8	4.000	EA	974004-006	WSR F 1/4 .734X.312X.065 SBZ
10	4.000	EA	963018-008	CLAMP HOSE 2-EAR 5/16
11	1.000	EA	1030-0118	CLAMP MACHINED LEFT
12	2.000	EA	974005-006	WSR F 1/4 .468X.255X.032 SBZ
13	1.000	EA	1030-0878	CLAMP MACHINED RIGHT
14	2.000	EA	2380-0136	FTG STR MALE 3/16 TB X 1/8 NPT
15	2.000	EA	963020-001	FTG 1/8 FEM NPT 1/8 TUBE ID
16	1.000	EA	1034-0012	CABLE ASSY PROBE

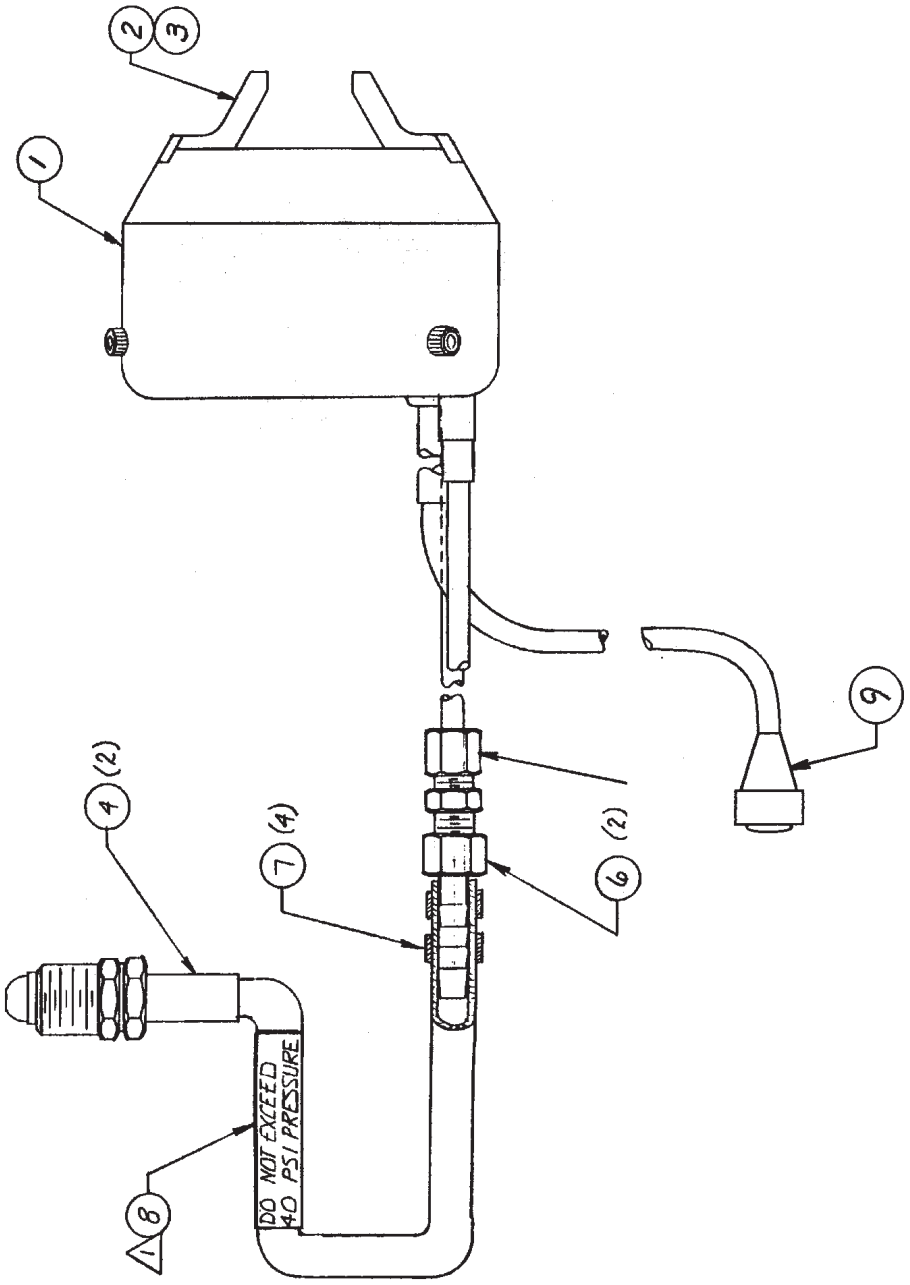

FIGURE 37 - MP-2 MAGNETIC ARC PROBE EXPLODED VIEW

TABLE 17 - MP-2 MAGNETIC ARC PROBE PART LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	1026-0370	PROBE SUB ASSY-MAG
2	2.000	EA	1033-0203	TIP STD PROBE 4608C
3	2.000	EA	970015-302	SCREW 6-32X.25 HSC SBZ
4	2.000	EA	2380-0161	ASSY WATER HOSE - 12FT
5	2.000	EA	2380-0136	FTG STR MALE 3/16 TB X 1/8 NPT
6	2.000	EA	963020-001	FTG 1/8 FEM NPT 1/8 TUBE ID
7	4.000	EA	963018-008	CLAMP HOSE 2-EAR 5/16
9	1.000	EA	2200-0616	CONN CIRC STR PLUG 8-4P

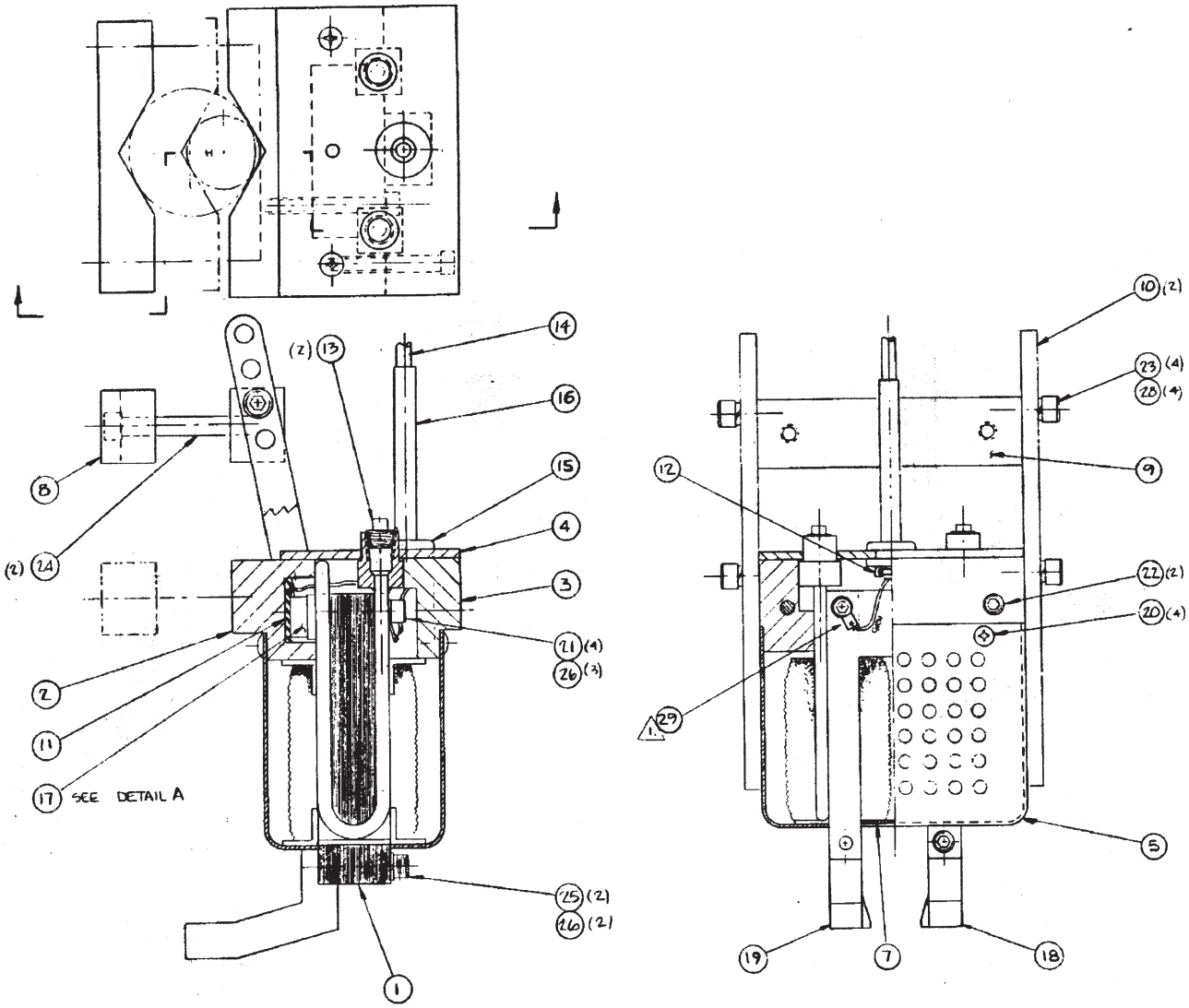

FIGURE 38 - MP-22 MAGNETIC ARC PROBE EXPLODED VIEW

TABLE 18 - MP-22 MAGNETIC ARC PROBE PARTS LIST

ITEM #	QPA	UM	PART #	DESCRIPTION
1	1.000	EA	1026-0141	MAGNET ASSY
2	1.000	EA	1030-0703	HOUSING BACK
3	1.000	EA	1030-0711	HOUSING FRONT
4	1.000	EA	1032-0143	COVER END
5	1.000	EA	1036-0064	COVER HEAT SHIELD
7	1.000	EA	1037-0116	INSULATOR - COVER
8	1.000	EA	1030-0207	CLAMP TORCH
9	1.000	EA	1030-0215	CLAMP TORCH
10	2.000	EA	1030-0223	LINK TORCH CLAMP
11	1.000	EA	1037-0108	PAD THERMOSTAT
12	1.000	EA	979001-001	CABLE TIE .75 BUNDLE DIA
13	2.000	EA	2380-0004	PLUG 1/8IN NPT BRASS
14	1.000	EA	1034-0047	ASSY CABLE 10FT-6IN
15	1.000	EA	976000-008	GROMMET RUBBER 5/16IDX3/4 OD
17	1.000	EA	2120-0026	THERMOSTAT 375F
18	1.000	EA	1030-0231	TIP RIGHT PROBE 4615
19	1.000	EA	1030-0240	TIP LEFT PROBE 4615
20	4.000	EA	2408-1001	SCR TRUSS HD PH 6-32 X3/8
21	2.000	EA	970015-518	SCR 10-32X1.50 HSC SBZ
22	2.000	EA	970015-418	SCREW 8-32X1.50 HSC SBZ
23	4.000	EA	970015-610	SCREW 1/4-20X.75 HSC SBZ
24	2.000	EA	970015-622	SCREW 1/4-20 X 2.00 HSC SBZ
25	2.000	EA	970015-416	SCR 8-32X1.25 HSC SBZ
26	5.000	EA	974010-004	WSR SL #8.293X.175X.040 SBZ
28	4.000	EA	974010-006	WSR SL 1/4.489X.263X.062 SBZ
29	1.000	EA	932009-007	LUG SOLDER #8

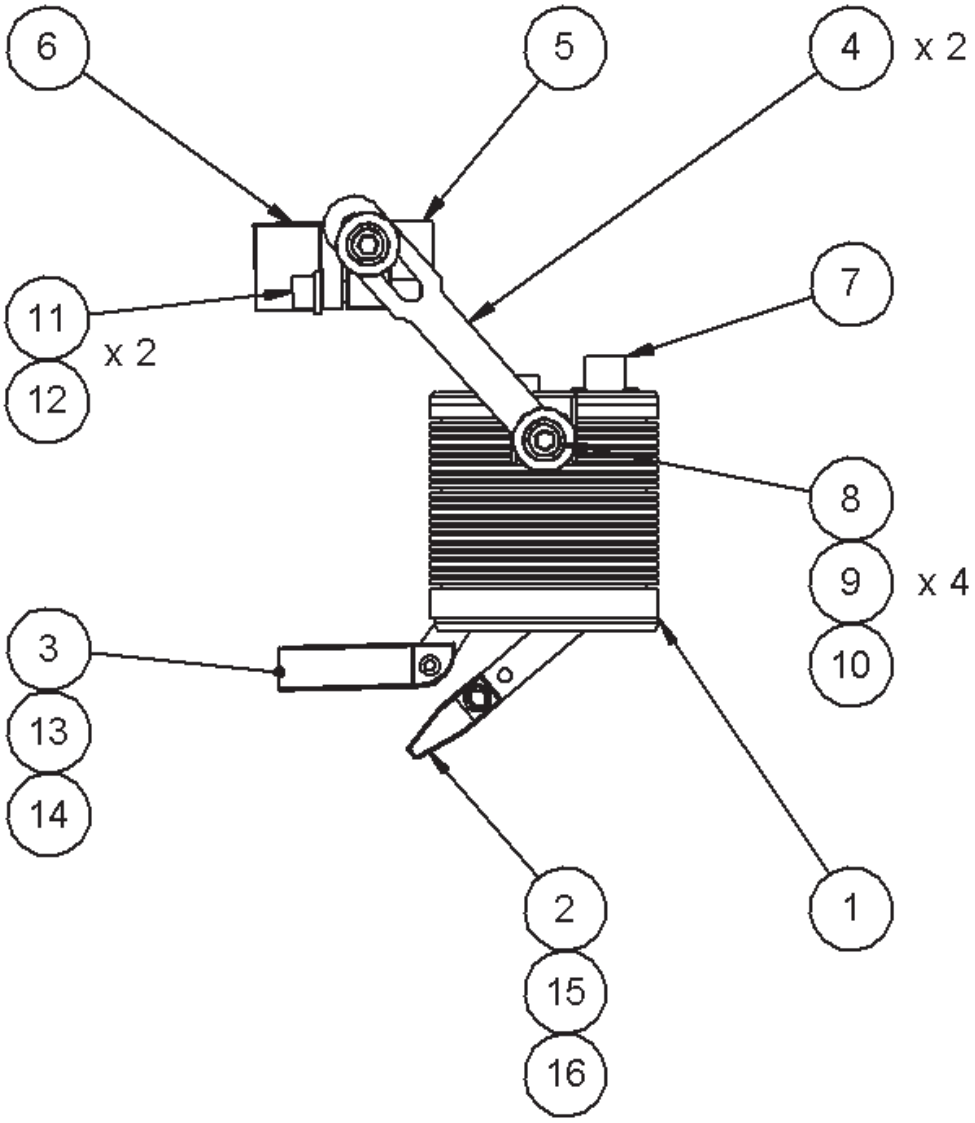

FIGURE 39 - MP-100 MAGNETIC ARC PROBE EXPLODED VIEW

TABLE 19 - MP-100 MAGNETIC ARC PROBE PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	0600-0470	MP-100 POTTED PROBE COIL ASSY
2	1.000	EA	0600-0320	MP-100 PROBE TIP STANDARD
3	1.000	EA	0600-0318	MP-100 RETURN RING
4	2.000	EA	1030-0100	LINK MOUNTING CLAMP
5	1.000	EA	1030-0878	CLAMP MACHINED RIGHT
6	1.000	EA	1030-0118	CLAMP MACHINED LEFT
7	2.000	EA	2200-0527	CONN CIRC BOX RCPT 8-4S
8	4.000	EA	970015-608	SCR 1/4-20X.62 HSC SBZ
9	4.000	EA	974010-006	WSR SL 1/4.489X.263X.062 SBZ
10	4.000	EA	974004-006	WSR F 1/4 .734X.312X.065 SBZ
11	2.000	EA	970015-616	SCR 1/4-20X1.25 HSC SBZ
12	2.000	EA	974005-006	WSR F 1/4 .468X.255X.032 SBZ
13	1.000	EA	0600-0322	BOLT 10-32X1.00 SOCHD
14	2.000	EA	974010-005	WSR SL #10 .334X.202X.047 SBZ
15	1.000	EA	0600-0321	BOLT 10-32X.5 SOCHD
16	1.000	EA	972005-005	NUT 10-32 HB
17	1.000	EA	0600-0329	WATERHOSE, MP-100 w/FITTINGS (NOT SHOWN)

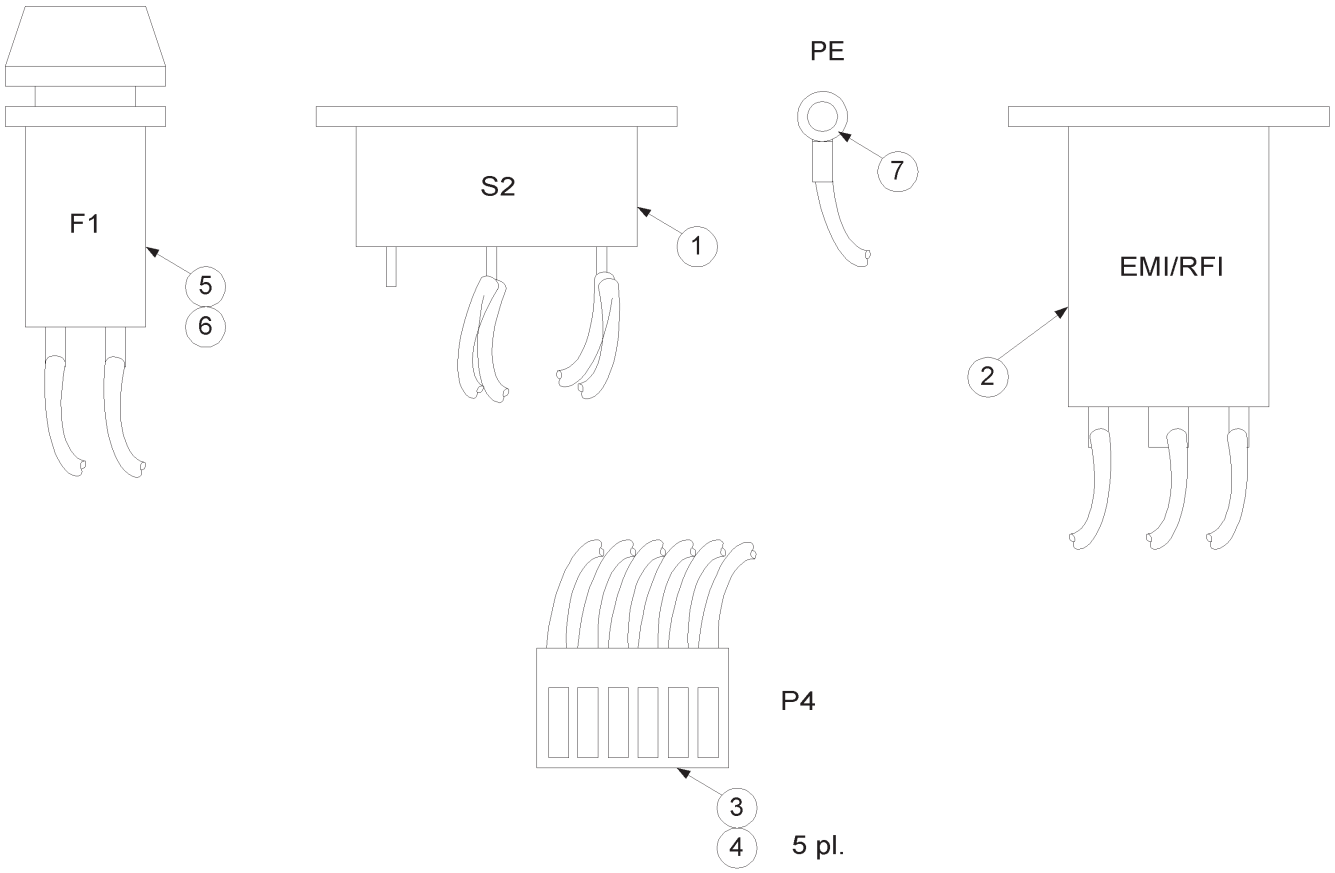

FIGURE 40 - VOLTAGE SELECTOR SWITCH ASSEMBLY EXPLODED VIEW

TABLE 20 - VOLTAGE SELECTOR SWITCH ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	920035-001	SLIDE SW 2 POS LINE VOLT SEL
2	1.000	EA	2120-0123	FILTER RFI-PWR LINE 3 AMP
3	1.000	EA	2208-0551	CONN RECT PLUG (6 PIN) .200"P
4	5.000	EA	2212-0152	TERMINAL CRIMP PIN 18-24 GA
5	1.000	EA	2120-0000	FUSE CARRIER 1/4 X 1 1/4 FEK
6	1.000	EA	2360-6087	FUSE 2.5A 250V
7	1.000	EA	2340-0618	TERM RING 1/4 22/16 RED

TROUBLESHOOTING

The following list describes typical problems and suggested corrective procedures.

The Circuit Descriptions section, which includes block diagrams and schematics, will also be a helpful reference for troubleshooting.

WARNING

Full line voltage is exposed inside the control unit.

Do not turn the power “On” when the Main board is removed, partially removed or disconnected.

RECOMMENDED SPARES FOR TROUBLESHOOTING

This manual was written in a manner to provide enough detail to identify individual components, parts, and subassemblies for maintenance purposes. A recommended spare parts lists is given in Table 22 - Recommended Spare Parts on page 43. For troubleshooting, the following items are recommended to isolate most problems.

TABLE 21 - TROUBLESHOOTING

PROBLEM #	DESCRIPTION	CAUSE	SOLUTION
Problem 1	Lamp is not lit	• Unit unplugged • Blown Fuse • Lamp is bad	• Plug unit into an appropriate AC Source • Replace Fuse • Replace Lamp
Problem 2	Power Switch and Indicator Lamp are ON, but nothing works	• Cables disconnected from the control to other components of the system • Connectors are disconnected inside the control • Power Driver Board voltages are not present	• Check cables from the control to other components of the system • Check connectors inside the control unit • Check Power Driver Board voltage +12VDC
Problem 3	Magnetic Probe will not deflect the arc	• Probe Coil is open • No Output from Main Board • Main Board Faulty	• Check Probe Coil for 5 to 15 ohms depending on the probe • Check for output voltage at probe connector on control unit • Replace Main Board

Many of the Integrated Circuits (IC’s) on the Main board are CMOS logic, and require standard CMOS precautions against damage by static electricity discharge.

TABLE 22 - RECOMMENDED SPARE PARTS

ITEM #	QTY	PART #	DESCRIPTION
1	2	1373-3041	Fuse, 1 Amps
2	1	2100-0086	Power Lamp
3	1	0600-0384	Main Board Assembly
5	1	2068-0161	Power Switch

TABLE 23 - VOLTAGE POINTS MAIN BOARD

POSITION	DESCRIPTION	VALUES
U15-1	+24VDC	+24VDC ±1.00VDC
U1-1	+15VDC	+15VDC ±1.00VDC
U15-3	+12VDC	+12VDC ±0.500VDC
J2-8	+5VDC	+5VDC ±0.500VDC
J2-9	-5VDC	-5VDC ±0.500VDC
U1-2	Ground Reference	Ground

CIRCUIT DESCRIPTIONS

WARNING

For use by Qualified Service Technicians

SYSTEM WIRING DIAGRAM

The Figure 44 - MA-20 Magnetic Arc Control Block Diagram and Figure 45 - MA-20 Magnetic Arc Control Block Diagram (Cont.) beginning on page 48 is a circuit diagram of the entire MA-20 Magnetic Arc Control System. These diagrams include detailed schematics of all portions of the system except the Main Board assembly. Schematics of each of the probes are also provided and begin on page 47.

The Figures 44 and 45 show all wires and connector pins in the interfaces between the various assemblies in the control unit. Figure 31 - MA-20 Magnetic Arc Control Exploded View on page 28 identifies the major assemblies. Parts lists for each assembly are also included in the Drawing and Parts Lists section beginning on page 27.

MAIN BOARD ASSEMBLY

This section will describe generally the circuitry, signal flows and test points on the Main board to assist in a better understanding and more effective and accurate troubleshooting of the system. The Figure 30 - MA-20 Main Board Layout on page 27 is a drawing of the board to assist in placement of the DIP switch settings and other components for better understanding and troubleshooting. In addition to the board layout drawing, Figure 41 - MA-20 Magnetic Arc Control Signal Flow on page 46 illustrates very simply the flow of signals in the MA-20 control system.

The Main board contains control circuitry for the system and also performs primary input voltage and control voltage regulation. Input voltage to the control unit is supplied to the Main board through a fuse and Radio Frequency Interference and Electro-Magnetic Interference (RFI/EMI) filter and voltage selector switch mounted on the bottom of the enclosure. The system will operate from 110/220 VAC, 50/60 Hz at less than 1 amps input power.

The voltage into the control unit is brought to the Main board and is then routed through the power On/Off switch located on the door of the enclosure. Once the switch is in the On position, voltage is passed through the transformer to step down the primary input voltage to an acceptable voltage for use by the control circuitry on the main board.

The voltage is rectified on the board and filtered through electrolytic capacitors. The resultant +40VDC and +18VDC is used as the source voltage for the probe driver circuit. All voltages are referenced to power ground.

The Main board is, as the name implies, the primary controller of the MA-20 System.

Additionally, DIP Switches are also incorporated to select other processes and / or features for use in the magnetic arc control process.

The waveform generation for the magnetic arc control is embedded in a microcontroller. With power applied to the unit and power turned On, the microcontroller creates the necessary waveform based upon the six potentiometer control settings on the front panel. Once the waveforms have been generated by the microcontroller, the signals are passed to the porbe power driver circuit, creating the magnetic field necessary to control the arc.

NOTE

Troubleshooting of this board, because of this embedded circuitry, is difficult and should be limited to the board replacement.

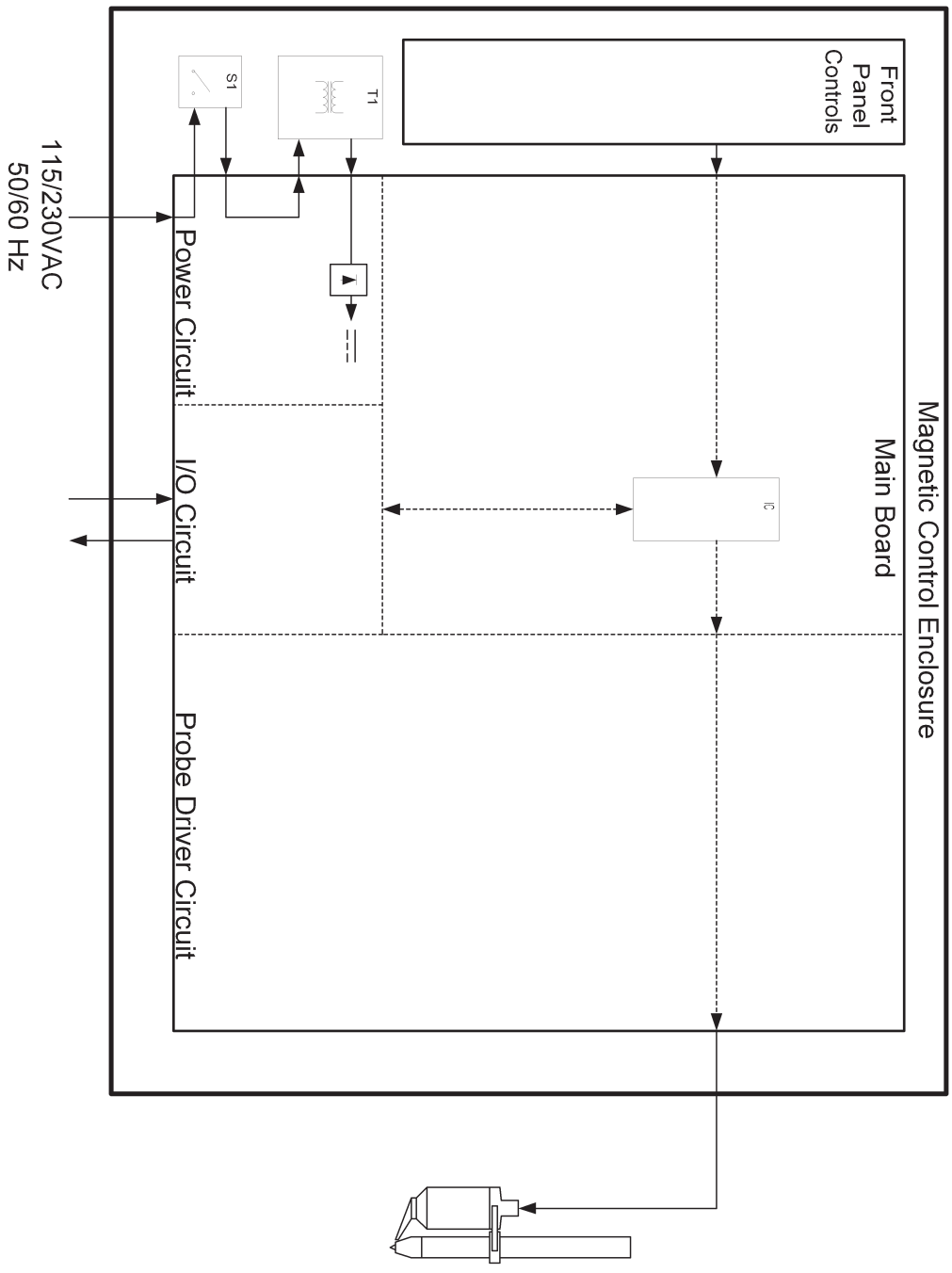

FIGURE 41 - MA-20 MAGNETIC ARC CONTROL SIGNAL FLOW

SCHEMATICS AND BLOCK DIAGRAMS

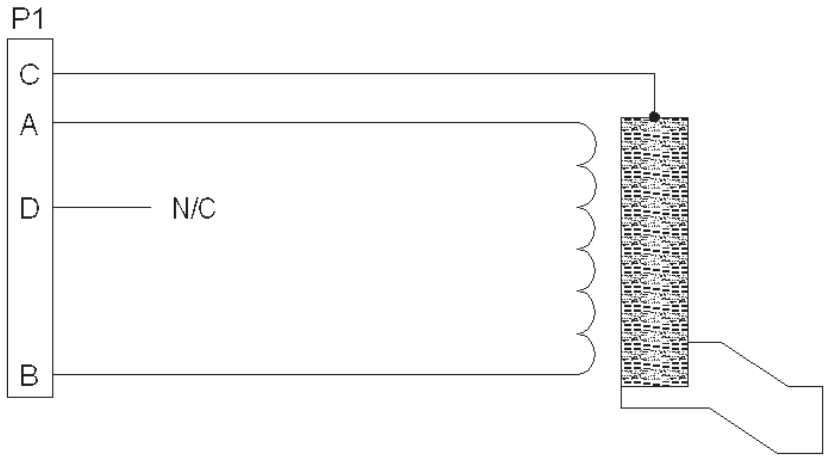

FIGURE 42 - MP-1 MAGNETIC ARC PROBE BLOCK DIAGRAM

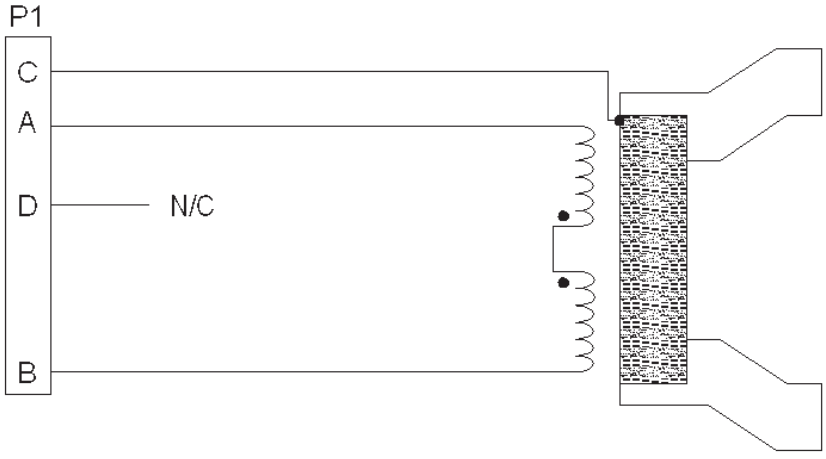

FIGURE 43 - MP-2 MAGNEITC ARC PROBE BLOCK DIAGRAM

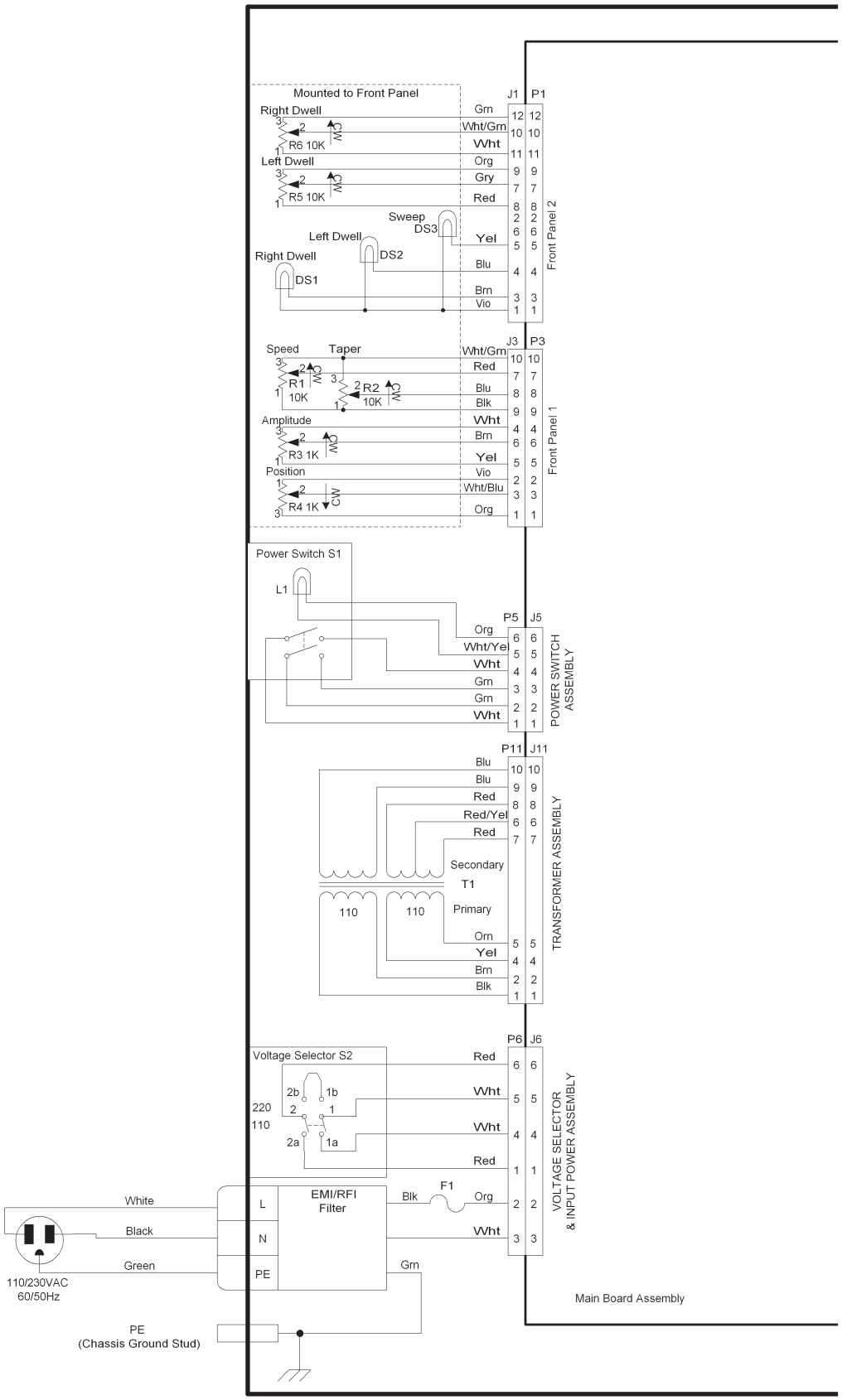

FIGURE 44 - MA-20 MAGNETIC ARC CONTROL BLOCK DIAGRAM

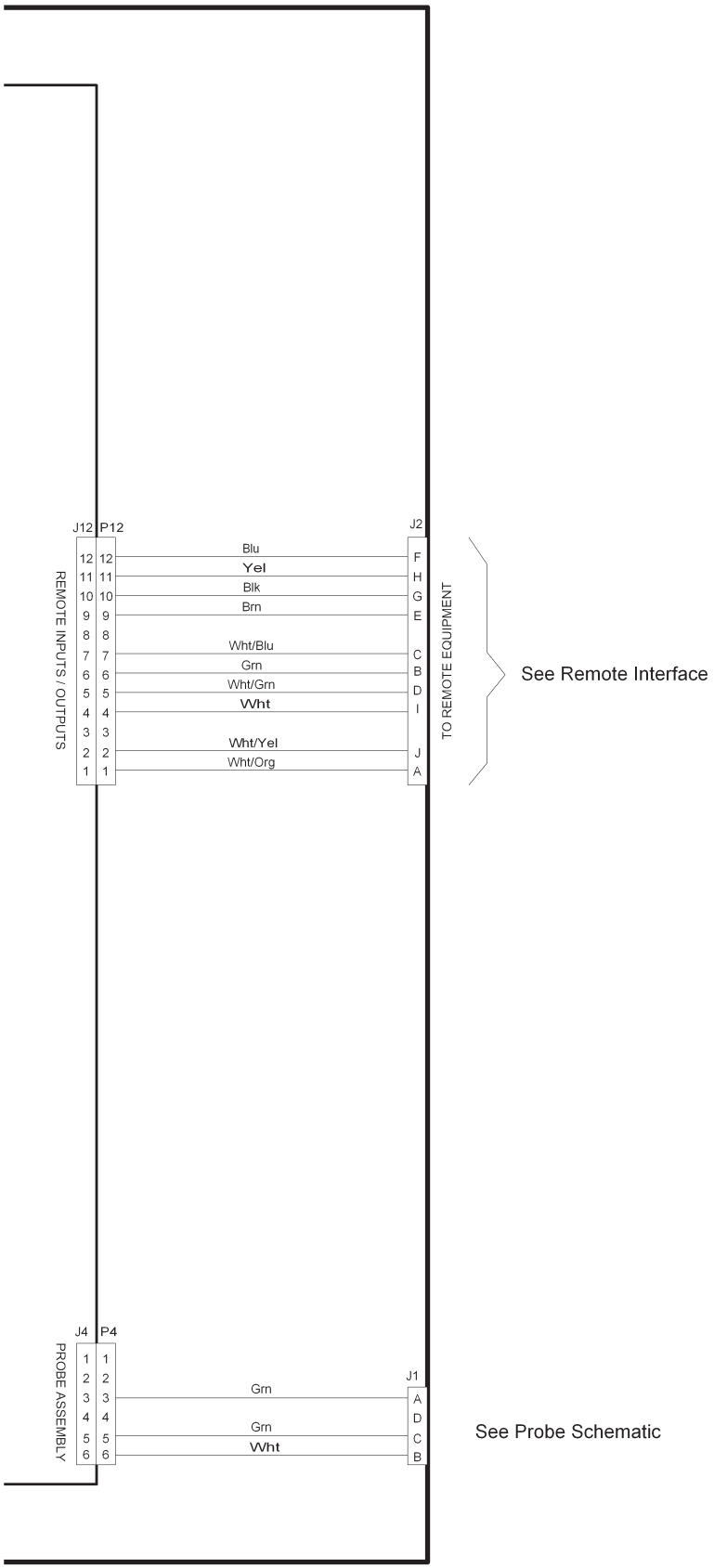

FIGURE 45 - MA-20 MAGNETIC ARC CONTROL BLOCK DIAGRAM (CONT.)

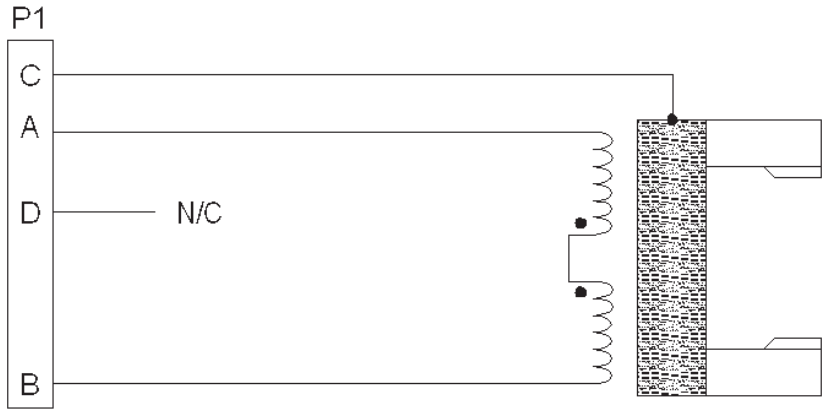

FIGURE 46 - MP-22 MAGNETIC ARC PROBE BLOCK DIAGRAM

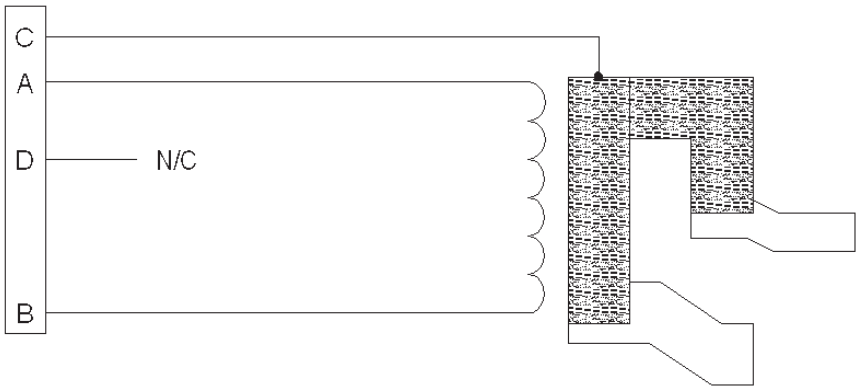

FIGURE 47 - MP-100 MAGNETIC ARC PROBE BLOCK DIAGRAM

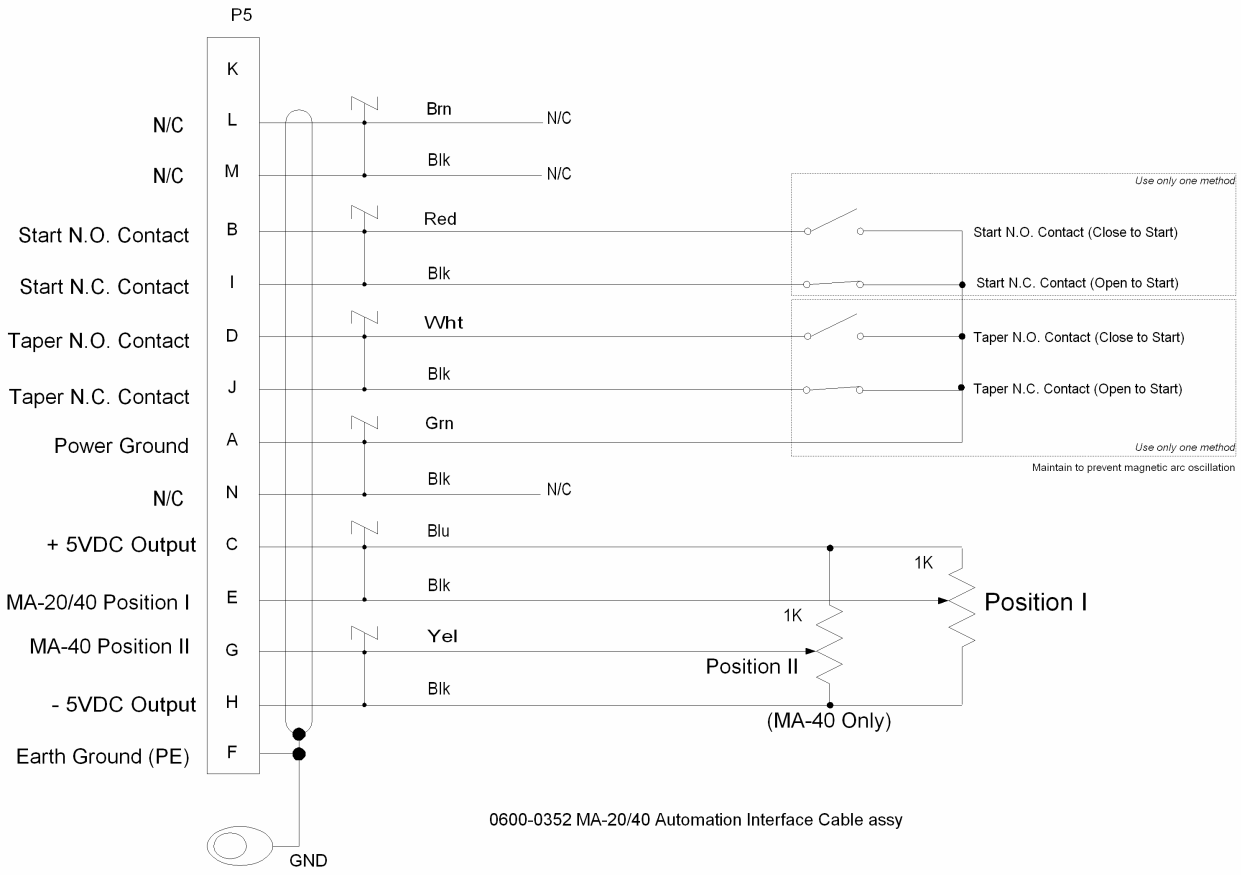

FIGURE 48 - MA-20 MAGNETIC ARC CONTROL INTERFACE CABLE SCHEMATIC

INDEX

A

adequate . . . . . xi- xii
Amplitude 17

B

barrel xi

C

Cable 8,25,43
carriage xii
CMOS 43
Control xii,3,8
current . . . . . xi- xii,3

D

diagram 25,43,45
diagrams 43
duration xii
dust xi,25
Dwell 17

E

electrolytic 45
Electro-Magnetic Interference . . . 45
EMI 45
enclosure 3,8,45
Equipment x,3- 5
Exploded 28,34,40

F

faulty x
Field xii
fuse holder 3

G

ground . . . . . x- xii,45

H

held xii

I

IC . . . . . x- xii,43
Integrated Circuits 43
Inhibit 19
input 45
insulated x
Integrated Circuits 43
interface 45

L

Lamp 43
lug xi,25,43

M

Main board 43,45
maintained x
Maintenance 25- 26
manual x,43
momentary xi

O

ON . . . . . x- xii,3- 5,21,43,45- 46
Oscillate 17
output xii

P

Panel 17
panels xii
parts list 43
periodic 25
Position 17
power switch 3
Precautions x
primary 45
Problem 43
Programmable Logic Controllers . . xii

Q

Qualified 45

R

Radio Frequency Interference . . . 45
rectified 45
Remote 17
Requirements 25
RFI 45
rod xi

S

Safety
Information x
Schedule 25
schematics 43,45
selector 45
Service x,45
shield . . . . . xi- xii
source xi,45
Stabilize 17
static electricity discharge 43
Sweep 17

T

Taper 17
Technicians 45
test points 45
torch . . . . . x- xii
travel xi
Troubleshooting 43- 44

V

Voltage 43,45

W

wiring 25

ARC PRODUCTS, INC
1245 30TH STREET
SAN DIEGO, CA 92154-3477
619-628-1022
619-628-1028 FAX
sales@arc-products.com
service@arc-products.com
www.ap-automation.com
www.arc-products.com

0600-0312 Rev. D September 2011